CLINICAL MANUALS

FOR

PRACTITIONERS AND STUDENTS

OF MEDICINE.

FOOD

IN

HEALTH AND DISEASE.

BY

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To

SIR WILLIAM ROBERTS, M.D., F.R.S.,

IN ADMIRATION OF HIS

MASTERLY RESEARCHES IN PRACTICAL DIETETICS,

THIS HUMBLE CONTRIBUTION TO THE STUDY OF THAT SUBJECT

IS DEDICATED.

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PART II.—FOOD IN DISEASE.

FOOD IN HEALTH AND DISEASE.

Part I.

FOOD IN HEALTH.

CHAPTER I.

THE NATURE, ORIGIN, AND PURPOSE OF FOOD—CLASSIFICATION OF FOOD—METABOLISM.

ALL living things undergo change. Change is a necessary condition of growth and development, of decay and of repair. Change, *change of substance*, is, then, a necessary and constant condition of life and activity.

In the living and normally active body there are, therefore, always changes taking place, losses proceeding from within, and gains accruing from without to compensate for those losses; otherwise it would cease to be active, it would cease to live.

These gains from without are derived from what we call Food, and the purpose of food is to supply the living organism, however complex or however simple it may be, with the substances or elements necessary for its growth and repair, and for the production and execution of those forms or modes of energy which we speak of as its functions.

A perfect and complete food for any living thing must necessarily comprise all the elements of which its tissues and all the solids and fluids of its body are composed.

We see, then, that the simplest forms of vegetable life derive their food from the atmosphere in which they live and grow. The elements of the carbonic acid, and the ammonia, and the water always present therein, sufficing for their nutrition and growth. The higher vegetable forms, in addition to the elements they derive from the constituents of the atmosphere, are able by their roots to absorb and use as food the inorganic salts of the soil. In this way, under the influence of the solar rays, vegetable organisms prepare and store up organic compounds suitable for the food of animals.

Animals, in the processes of nutrition, and in the development of their various forms of energy, feed upon, that is to say, appropriate, these products of vegetable life; convert them into other organic compounds, or decompose them in the processes of nutrition, with the aid of the oxygen absorbed from the air, into simpler substances, which are in course of time restored to the atmosphere and to the soil, and resolved finally into the simple elements from which they originally proceeded.

It is not necessary, for our present purpose, that we should pursue the subject of the origin and nature of food, in its general sense, further than this. The subject of dietetics is a practical one, and it is with the question of food in relation to the various practical wants of the human body, in health and in disease, that we are now concerned.

The various organic and inorganic compounds which enter into the composition of the human body may all be resolved into the following twelve elements :—carbon, hydrogen, oxygen, nitrogen (these four in far greater proportions than the others), sulphur, phosphorus, chlorine, iodine, potassium, calcium, magnesium, and iron. A few other elements (such as fluorine, silicon, manganese, etc.) have been

discovered in the human body, but it is doubtful if they are invariably or necessarily present.

All these twelve elements must be represented in the food of man, and they must be, for the most part, combined in the form of organic products capable of being appropriated by his digestive organs.

Classification of food: alimentary principles.—In attempting a general classification of foods, it is convenient and usual to examine, in the first place, the various definite compounds which can be derived by chemical analysis from the different substances commonly used as food, and these are termed *alimentary principles.*

The classification generally adopted was originally founded on the analysis of that perfect and *complete* food upon which the young of all mammalian animals for a time are fed, and which is therefore proved to contain all that is necessary for supporting and maintaining the growth, development, and activities of the animal body in its highest form. That perfect and *complete* food is *milk.* On analysing this fluid we find :—

1st. That it contains a large quantity of a principle rich in nitrogen, termed *casein*, as well as some other nitrogenous or *albuminous* substances in small quantity.

2nd. It contains a considerable quantity of *oil* or *fat* (cream or butter).

3rd. It contains a *form of sugar*, namely, *lactose* or *lactine* (milk sugar).

4th. It contains *water* holding in solution various *mineral constituents* or salts (chiefly chlorides, phosphates, and sulphates of magnesium, calcium, potassium, sodium, and iron).

Adopting this convenient basis of classification, we are enabled to establish four great divisions of alimentary principles, the members of each group

possessing a remarkable similarity of composition, and differing widely both in physical and chemical characters from the members of the other groups.

These different groups also appear to serve, more or less, different purposes in nutrition, although to some extent the members of one group may replace those of another; and a combination of all four classes appears to be necessary for the maintenance of the body in perfect health.

1. The 1st class, comprising the chief *nitrogenous* alimentary principles, may be conveniently termed *albuminates* (albumen being taken as the typical member of the group). These used at one time to be named *proteids* (a term still employed by many authors), from the circumstance that they could all be made to yield the substance *protein*, which is now, however, simply regarded as a product of chemical manipulation.

The chief of these nitrogenous alimentary principles are:—

Blood fibrin.
Syntonin, or muscle fibrin.
Myosin, from muscle.
Albumen in its various forms.
Vegetable fibrin, or *Gluten.*
Casein, animal and vegetable, the latter sometimes termed *Legumin.*
Globulin, occurring in the contents of the blood corpuscles.

The members of this class present a remarkable uniformity of chemical composition, and can replace one another in nutrition. They contain from 15·9 to 16·5 per cent. of nitrogen; their other elements being carbon, hydrogen, oxygen, and sulphur, or phosphorus.

The following is a close [illegible] to their percentage composition:—

butter; others quite fluid, as the oils. They vary also in their digestibility, and therefore in their value as foods.

3. The 3rd class comprises all the *starchy* and *saccharine* substances used as food, and these are termed *carbo-hydrates*, from their chemical composition, in which hydrogen and oxygen exist in the proportions to form water. The composition of starch, which may be taken as a type of this group, is

$$C_6H_{10}O_5.$$

The chief members of this class are :—

The various vegetable Starches.
Cane, Grape, and Milk Sugar (Sucrose, Glucose, and Lactose).
Gum : Dextrin.
Cellulose :

together with a few other substances closely related to them in chemical composition. *Pectin*, or vegetable jelly, is sometimes referred to this class, although it does not contain hydrogen and oxygen in the proportions to form water.

4. The 4th class includes *water* and the various *mineral substances* which occur in the animal body.

These four groups of alimentary principles comprise all that is necessary for the growth, maintenance and activities of the animal body.

In addition, however, to these four groups, may be mentioned the various substances termed *food accessories*, comprising the several condiments which give flavour to food, or stimulate the digestive secretions, and the well-known "stimulants," tea, coffee, cocoa, alcohol, etc.

Foods have also been classified into *organic*, those derived from the animal and vegetable kingdoms, and *inorganic*, namely, mineral substances or salts; also into *nitrogenous*, those containing the element nitrogen, and *non-nitrogenous*, those containing no nitrogen.

possesses of accumulating from its food supplies a store of *potential* energy, which it is able to transform into *kinetic* energy, and which manifests itself commonly in the form of muscular work and the production of heat. It further includes the formation of those *excretory* products which result from the changes which occur in the constituents of the tissues as the necessary accompaniment of such transformations of energy.

Normal, healthy metabolism, therefore, requires a due supply of suitable food, suitable in quality and quantity; it also involves the storing up of a portion of this food within the body; and it demands a regular chemical transformation of the tissues, and the formation of the effete excretory products resulting from these changes, which have to be eliminated through the organs provided for that purpose.

The term *equilibrium of the metabolism* is used to signify that the bodily income and expenditure are balanced; that while the normal physiological conditions are maintained, there is exactly the same amount of new material absorbed and assimilated as there is of effete matter, the products of the retrogressive tissue-changes, removed by the organs of excretion; the destruction of tissue is exactly compensated for by the formation of new tissue. Of course, while the body is *growing* rapidly there is greatly increased formation in the parts participating in the rapid growth, and the metabolism in these parts is correspondingly increased; on the other hand, during senile decay the expenditure is in excess, and the body in consequence wastes.

The *physiological equilibrium* is practically determined by physicians by simply weighing their patients, and observing that the body remains of the normal weight with a given diet.

When the body is in this state of physiological

CHAPTER II.

THE NUTRITIVE VALUE AND USES OF THE DIFFERENT CLASSES OF FOOD.

WE must, in the next place, pass on to the consideration of the purposes or uses, in the nutrition and maintenance of the structure and functions of the body, of the several groups of alimentary substances set forth in the last chapter.

As the human body is chiefly composed of albuminous or nitrogenous substances,* and as the various functions of the body are mainly concerned with the physical and chemical changes these undergo, we shall be prepared to find that the class of *albuminates*, or the nitrogen-containing group of foods, plays a very important part in its nutrition, and in the development and maintenance of its energies.

It has been pointed out † "that the presence of nitrogen in an organised structure, and its participation in the actions going on there, is a necessary condition for the manifestation of any energy, or any chemical change. . . If the nitrogen be cut off from the body, the various functions languish. This does not occur at once, for every body contains a store of nitrogen, but it is at length inevitable. . . If it is wished to increase the manifestations of the energies of the various organs, more nitrogen must be supplied; . . . without the participation of the nitrogenous bodies, no oxidation or manifestation of energy is possible."

Liebig's theory, which taught that the functional

* "The skeletal muscles form nearly half the body."—Foster, "Text-Book of Physiology."

† Parkes's "Hygiene," chap. v. on Food, 6th edition. By Professor de Chaumont.

must undergo such chemical changes in the system as result finally in the production of urea. They must therefore play an important part in the "absorption and utilisation" of oxygen in the system.

It has in the third place been experimentally established that *fat* may be formed at the expense of albuminates; "so that the nitrogenous substance plays two parts: 1st, that of the organic framework, *i.e.* of the regulator of oxidation and of transformation of energy; and 2nd, it may form a non-nitrogenous substance which is oxidised and transformed." *

Voit has pointed out that the albumen in the body exists in two conditions: 1st, that which is organised, and which forms part of the tissues, and which may, therefore, be termed "*organic* albumen;" and 2nd, that which exists in the fluids, permeating all the tissues, and which may be called "*circulating* albumen." The former is relatively stable, but the latter undergoes rapid changes in the processes of functional activity: whereas, according to Voit, 70 per cent. of the latter is used up in twenty-four hours, only 1 per cent. of the former is consumed.

It is now generally admitted that, in ordinary conditions, only a small amount of the "organic albumen" undergoes decomposition, and that metabolism of the nitrogenous tissues is but slightly influenced by the activity of the organism. On the other hand, the "*circulating* albumen" under the influence of the cellular elements of the tissues undergoes transformation to a considerable extent, such transformation probably taking the form of a splitting-up of its constituent elements into nitrogenous waste substances such as creatin, uric acid, and especially urea, which are rapidly eliminated, and non-nitrogenous substances, some of which may be deposited in the tissues in the form of fat, and some may be consumed and

* Parkes's "Hygiene," chap. v., on Food.

which combine with 12·3 grammes of water, and after the elimination of 27·4 grammes of carbonic acid, yield 51·39 grammes of fat. *

Lawes' and Gilbert's experiments on the fattening of pigs appeared to show that two-thirds of the total fat stored up must have originated in other sources than the fat taken in the food. It would seem, also, that even glycogen and sugar can be formed from albuminous substances, for glycogen has been found in the liver of animals fed exclusively on albumen and fibrin,† and in certain forms of diabetes, the sugar must be derived "either from albuminates or fats, most probably the former." ‡

In the pathological condition known as *fatty* degeneration, the fat deposited in the tissues appears to be formed at the expense, and by the splitting-up, of the "organic albumen."

The functions of the class of albuminates may now be thus briefly recapitulated :—(1) They are the essential agents by which the nitrogenous organised tissues are developed and repaired, as well as all the other nitrogenous substances in the fluids and secretions of the body; (2) They stimulate functional activity, and promote oxidation and metabolism in the body; (3) They are capable of splitting-up in the organism into a nitrogenous and a non-nitrogenous part, and from the latter fat may be formed and deposited in the tissues or consumed in the production of force.

Before passing on to the consideration of the food-value of the other classes of alimentary substances, it will be well to state what has been determined as to the utility in nutrition of the *gelatigenous* substances,

* Bauer, "Dietary of the Sick," p. 27. Von Ziemssen's "Handbook of General Therapeutics."

† G. Sée, "Du Régime Alimentaire," p. 13.

‡ Parkes's "Hygiene," 6th edition.

especially appropriate to those febrile states in which the stability of the "organic albumen" is threatened, and at the same time the capacity of assimilating albuminous food is greatly diminished.

In the next place we must consider the purposes served by the class of *fats* or *hydro-carbons* in nutrition. Liebig's views with regard to this subject also have been shown to be erroneous. He considered the function of fats to be *entirely* respiratory, and that by combining with oxygen, admitted into the system in respiration, they were consumed in the production of heat, and that the completeness of this combustion depended on the amount of inspired oxygen. But it has been observed that when an exclusive diet of fat has been taken, there has been *less* fat metabolised and less oxygen absorbed than in fasting, and also that, in certain circumstances, the whole of the albumen in the food is metabolised in the body, and the fat is appropriated to increase the body-weight; an inversion of the formerly assumed *rôles* of hydrocarbons and albuminates. From which it would appear that, under certain conditions, fat is split up into simpler bodies with greater difficulty than albumen, and must not, therefore, be regarded as the same easily combustible substance in the organism that it is outside.

It is not then through the direct action of oxygen that the non-nitrogenous foods any more than the nitrogenous ones are split up into simpler products, but *by the agency of the cellular tissues*, and the oxygen enters into these products "little by little." Indeed, under the influence of fat tissue-waste is lessened, and, therefore, less oxygen is taken into the system; less oxygen being abstracted from the blood by the products of metabolism.

We thus see that one of the great purposes served

a certain extent, opposed to one another in their action on the organism, as the former increase waste and promote oxidation, while the latter have the effect of diminishing them, and this they do probably by affecting the metabolic activity of the cells of the tissues themselves. It is a matter of common observation that fat animals bear privation of food better than thin ones; in the latter, their small store of fat is quickly consumed, and then the albumen is rapidly decomposed. It is for the same reason that corpulent persons, even on a very moderate amount of food, are apt to become still more corpulent.

The influence of fat in the storage of albumen is exemplified by the fact that if 1,500 grammes of lean meat be given alone, it will be wholly decomposed; but if 100 to 150 grammes of fat be added, then it will yield only 1,422 grammes of waste. It has also been shown that the balance of income and expenditure of albuminates, although the amount taken in the food may be very small, is readily established as soon as one adds a certain quantity of fat. A dog who took daily 1,200 grammes of lean meat was observed to be still losing some of the albuminous constituents of the body; whereas, with only 500 grammes of flesh and 200 grammes of fat, the nutritive balance was rapidly re-established. The same has been observed in man. Rubner found that an individual taking daily 1,435 grammes of meat, containing 48·8 grammes of nitrogen, lost by the kidneys 50·8 grammes of nitrogen; whereas another taking meat and bread containing 23·5 grammes of nitrogen, to which were added 191 grammes of fat, only eliminated 19 grammes of nitrogen on the second day of the diet;* so that a small quantity of albumen, when combined with fat, is sufficient to maintain the albuminous structures of the body. As a practical conclusion from these

* Germain Sée, "Du Régime Alimentaire."

do not appear to enter into the structure of the tissues, although they are found in some of the fluids and organs of the body.

All the carbo-hydrates are converted into glucose, or grape sugar (or maltose), before they are absorbed, and in this form they are much more readily metabolised than the fats or albuminates.

It is believed by many, and the weight of evidence, as will be seen, is in favour of the conclusion, that carbo-hydrates can be converted into fat within the organism. Bauer,* however, is indisposed to accept this view. Basing his opinions on the experiments of Pettenkofer and Voit, who showed that carbo-hydrates, even when administered in great excess, are almost completely destroyed within the body, he maintains that although the carbo-hydrates, when given together with albumen and fat, favour an increase of the constituents of the body, and especially of fat, yet it is not because they are themselves converted into fat, but because, owing to the facility with which they are metabolised, they protect the other food-stuffs from destruction.

"When fat and carbo-hydrates co-exist in the food, the latter are always the first to be consumed; and when they are present in sufficient amount, the consumption of fat in the body may be completely suspended." And he explains in a similar manner the fact that a deposit of fat may be observed to take place when the diet consists of albuminates and carbo-hydrates alone, *without any fat;* for in that case, he says, the fat, which "originates as a product of the splitting-up of albumen, is withdrawn from further metabolism in favour of the carbo-hydrates, and contributes to the gain." He also rejects the view that the ready decomposition of the carbo-hydrates in the body depends on their great

* "Dietary of the Sick: Value of Food Stuffs," p. 32.

the addition of hydrogen. He also shares, to a certain extent, Pavy's views, and considers that a portion of the glucose derived from the digestion of carbo-hydrates is deposited as "hepatic glycogen" in the liver, and thus furnishes the glucose necessary to the organism when the food does not contain any carbo-hydrates. Pavy maintains, as is well known, that saccharine matter, when absorbed, "on reaching the liver is transformed by that organ into amyloid substance [glycogen], which is stored up in its cells for subsequent further change preliminary to being appropriated to the purposes of life." The occurrence of this "amyloid substance" in the liver, even when a purely animal diet has been taken, he accounts for by the supposition that the liver is the organ in which the splitting-up of the albuminates into urea and a non-nitrogenous substance occurs, and that the latter is metamorphosed by the liver into "glycogen." Pavy believes that carbo-hydrates are first converted into this "amyloid substance," and that this is afterwards converted into fat. But he points out what is doubtless a most important condition in the conversion of carbo-hydrates into fat, namely, "the co-operation of nitrogenous in conjunction with saline matter," for it is probably by the changes occurring during the metabolism of the albuminates that this transformation is excited. The presence of a small amount of fat with the carbo-hydrates would seem also to favour this conversion, for the rapid deposition of fat which sometimes occurs when animals are fed on such a mixture appears to be more than can be accounted for by the small quantities of fat ingested. Pavy does not admit that any of the carbo-hydrates undergo *direct* oxidation in the system, or contribute *directly* to force production.

In connection with this interesting and important discussion, the following observations by Tscherwinsky

same class are formed in the body, chiefly or solely from carbo-hydrates, is drawn attention to by Parkes. "The formation of these acids is certainly most important in nutrition, for the various reactions of the fluids which offer so striking a contrast (the alkalinity of the blood, the acidity of most mucous secretions, of the sweat, urine, etc.), must be chiefly owing to the action of lactic acid on the phosphates or the chlorides, and to the ease with which it is oxidised and removed."

We may conclude, then, that the carbo-hydrates by their capacity for rapid metabolism contribute largely to the production of heat and mechanical work, and also that their use greatly favours an increase in the constituents of the body, and especially of the albumen and fat. If we desire to increase the albumen without adding greatly to the store of fat, we should (according to Bauer) give a liberal allowance of albuminates with relatively small quantities of carbo-hydrates. But if we desire a substantial addition to the fat, the food should contain less albumen and more carbo-hydrates, with a fair proportion of fats.

Our fourth class of foods comprised *mineral substances and water.* These are of great importance, and are as essential to nutrition as the albuminates. There is no tissue that does not contain lime, chiefly in the form of phosphate, and it would seem that cell growth cannot go on without it; indeed, calcium phosphate is the most abundant salt in the body, seeing that it forms more than one-half our bones. Calcium carbonate occurs associated with this phosphate, but in relatively much smaller quantity. Sodium chloride is also a very important salt which likewise occurs in all the tissues and fluids of the body. It plays a very important *rôle* in promoting the diffusion of fluids through membranes, and its

formed tissues, as the blood corpuscles and muscular fibre; and the sodium salts are found more abundantly in the interstitial fluids; so in the blood, sodium and the chlorides are found especially in the plasma, and potassium and phosphates in the corpuscles.

The chlorine of the chlorides would appear to be easily set free in the body, so that it can combine with hydrogen and form a powerful acid, having a special solvent action on albuminates. The sulphur and phosphorus of the tissues appear to be introduced, as such, in the albuminates.

All these mineral substances are introduced into the body as constituent parts of the various ordinary articles of human food, animal and vegetable, with the exception of sodium chloride, which is usually added to various articles of food, in greater or less amount, in addition to what they may themselves contain.

Certain salts, such as the lactates, tartrates, citrates, and acetates, become converted into carbonates within the body, and confer upon the system that alkalinity which appears to be necessary to the integrity of the molecular currents. "The state of malnutrition, which in its highest degree we call scurvy, appears to follow inevitably on their absence; and as they exist in fresh vegetables, it is a well-known rule of dietetics to supply these with great care, though their nutritive power otherwise is small." *

Rabuteau observed that the addition of 150 grains of sodium chloride to the daily rations increased notably the amount of urea excreted; it would seem, therefore, to promote the metabolism of albuminates; it acts probably simply by stimulating the digestive functions, and possibly increasing the acidity of the gastric juice. It is itself almost wholly eliminated in the urine.

* Parkes's "Hygiene," 6th edition, by De Chaumont.

well as the nature and amount of solid food. The need of the organism for water is usually indicated, when in health, by the sensation of thirst. An insufficient supply of water leads to disturbances in the circulation, and in the distribution of heat, and to the retention in the body of the waste products of metabolism. The free ingestion of water promotes an active circulation of the fluids, accelerates albuminous metabolism, and increases the activity of the kidneys and the amount of urine secreted. It has been asserted and denied by different observers that an increased consumption of water leads to an increased elimination of urea, and acts, therefore, as an accelerator of nutritive changes. The weight of evidence and authority are in favour of the affirmative view, but the influence is only temporary.

The various substances known as *stimulants* and *condiments*, although not included in either of the preceding classes, and although they may have no *direct* nutritive function, undoubtedly exercise an important indirect influence on the processes of nutrition. They stimulate appetite, and give relish to food, and by acting on the peripheral nerves, especially those of taste and smell, they promote the digestive secretions and rouse the digestive functions.

It has now been seen that each of these four classes of alimentary substances has a special value in nutrition, and although the members of one group may be competent to serve, to a certain extent, the purposes of those of another, yet in order to accomplish the best results a combination of all of them is required. An adequate diet must contain a mixture of several articles of food, in which all those classes are represented in due proportion.

Some differences of opinion exist as to the *relative*

It must, we think, be admitted that all practical observations tend to prove that animal food is digested more rapidly than vegetable food, and it therefore seems highly probable that meat can replace the waste of the nitrogenous tissues more rapidly than meal of any kind, and it is probably true that there is a more active change of tissue in meat eaters than in vegetable feeders, and that the former require more frequent supplies of food. Apparent differences in nutritive value in different meals, as in wheat-meal and barley-meal, probably depend on difference of digestibility.

The difference in the nutritive value of different fats would seem to depend on the relative facility with which they are digested and absorbed. Animal fats appear to be more easily absorbed than vegetable. And even different animal fats differ much in digestibility, and, therefore, in nutritive value. This depends partly on chemical composition, and partly on mechanical aggregation or subdivision. Mutton-fat is generally found difficult of digestion, while pork-fat is easily digested. Butter can be readily digested by many persons who cannot digest other forms of fat; and the ready digestibility of cod-liver oil is one of its chief advantages.

The different carbo-hydrates are generally supposed to be of equal value in nutrition. Sugar, from its ready solubility, should be more easily absorbed and more quickly utilised than starch, but it is found that when both are procurable a mixture of the two is usually preferred.

It will be convenient now to pass in review the

ORDINARY ARTICLES OF FOOD AND DRINK;

the various Alimentary Substances, or "Food-stuffs," as they are also termed.

Man, being an omnivorous animal, obtains his food supplies from a variety of sources. The various substances commonly employed in alimentation will therefore now be described, their composition, properties, digestibility, and nutritive value. Those derived from the *animal* kingdom will be first treated of; then those derived from the *vegetable* kingdom. Those substances used as condiments will also be considered, as well as the various *beverages* in common use.

CHAPTER III.

ANIMAL FOODS.

ANIMAL foods, by which is usually meant the flesh of animals, have certain decided advantages. In the first place, they contain the same chemical elements as the bodies they are destined to feed. They are very rich in albuminous or nitrogenous substances, combined with a certain amount of fat; they are more easily and completely digested and assimilated than vegetable foods; they are easily cooked, and develop agreeable flavours in the process; and they contain important salts (chiefly salts of potassium) and some iron.

Animal foods are therefore exceedingly well adapted to minister to the growth and maintenance of the organic structure of the body; their disadvantage is the absence of starch, so that they are not so well adapted as non-nitrogenous substances for the production of force. When, however, there is a mixture of a considerable proportion of fat with the muscle tissue, this disadvantage is greatly lessened.

In the flesh of all animals we find, besides muscular fibre, blood-vessels, nerves, fibrous connective tissues, and a variable proportion of fat.

Analysis of pure muscle shows it to consist, on an average, of 76 per cent. of water and 24 per cent. of solids.

The albuminates amount to about 20 per cent. in fresh muscle free from fat; by far the greater portion of this is in an *insoluble* form. The soluble albuminates consist chiefly of *myosin*, which, after death, undergoes spontaneous coagulation, and cooking causes a further coagulation; the other soluble albuminates are in small proportion, the chief in quantity being

meat is more tender and has a better flavour after it has disappeared. Hence the practice of "hanging" meat before cooking.

Different kinds of flesh differ considerably in quantitative composition, in flavour, in digestibility, and in nutritive qualities, according to a variety of circumstances, such as age, sex, state of nutrition, part of the body, etc., etc. Meat containing much fat is generally less digestible and less palatable than leaner varieties.

The flesh of young animals is less digestible than that of more mature ones; veal and lamb than beef and mutton; and with advancing age the flesh becomes tough and uneatable. There is less flavour, less stimulating properties, less nutritive value in the tissues of young animals than in mature ones, and they contain more gelatin. A four-year-old ox yields the best beef, and a three-year-old sheep the best mutton.

The flesh of the female has a finer grain and is more delicate than that of the male; while that of the entire male, during the breeding season, has a coarse and unpleasant flavour. Removal of the testes in the male and the ovaries in the female greatly improves their edible qualities.

It is usual in slaughtering animals for food to allow the blood, before or after death, to drain away as completely as possible; although this practice undoubtedly involves a loss of nutritive material, and is therefore wasteful, yet it is to some extent justified by the consideration that it improves the appearance of the meat, gives it delicacy of flavour, and enables it to be kept longer.

In civilised life all the animals used for food are vegetable feeders, and the character of the meat is often affected in a recognisable manner by the nature of the food. Pastures containing fragrant herbs,

Beef-fat consists of glycerides of the fatty acids in the proportion of 3 of stearic and palmitic to 1 of oleic. Its melting-point ranges between 41° and 50° C.

Veal.—Veal has, in Great Britain, always had the reputation of being less digestible and less nutritious than beef or mutton. It certainly contains a larger proportion of gelatin than beef. But it is more highly valued in other countries; and Bauer maintains that its fibres are tender, and that it is better borne by enfeebled digestive organs than beef. This difference of opinion no doubt depends on the different manner in which veal is killed and prepared in Britain and on the Continent. In England it is a much paler, ex-sanguine, and drier meat than on the Continent. It is probably killed younger, and bled too much before killing. The following table presents the composition of different joints of veal:—

	Water.	Nitrogenous Matters.	Fat.
Lean Veal . . .	78·82	19·76	0·82
Fat "	72·31	18·88	7·41
Loin	76·25	15·12	7·12
Ribs	72·66	20·57	5·12
Shoulder . . .	76·57	18·10	3·62
Leg	70·30	18·87	9·25

Mutton.—Mutton is generally considered to be more easy of digestion than beef. Its fibre is shorter and more tender. It often, however, contains a large proportion of fat, which is harder than beef-fat, as it contains more of the glyceride of stearic acid. Such fat mutton is unsuited to invalids, and often has a tallowy flavour.

Mutton, however, differs very greatly in quality

Of **bacon,** Pavy justly remarks that it "is less likely to disagree with the stomach than the fat of pork. It contains but a small proportion of water, and therefore, weight for weight, is an advantageous kind of food. . . . Its popular use, like that also of boiled pork, with lean meats such as veal, chicken, and rabbit, and also with other articles rich in nitrogenous matter, as eggs, beans, and peas, is founded upon a rational principle, serving, as it does, to establish a proper proportion in the supply of nitrogenous and carbonaceous material."

Besides the muscular tissue and fat of animals, some of the viscera, the blood, and even the bones may be utilised for food.

By breaking the **bones** into small pieces, and boiling for many hours, a nutritious extract is obtained, consisting chiefly of gelatin; 3 lb. of bone yielding about as much carbon as 1 lb. of meat, and as much nitrogen as 7 lb. of meat.

Bones can therefore be utilised advantageously in the composition of soup, especially in large public institutions.

The **brain** of animals is of soft consistence, and is no doubt nutritious, but it contains a large percentage of fat which renders it difficult of digestion by weak stomachs: the *tongue* also is tender, but is intimately permeated by fat.

The **blood** of the pig is made into a kind of food known as "black pudding," which contains also fat, groats, and some flavouring condiments.

Bullock's blood has also, at times, been prescribed for invalids, on the erroneous conception that it is especially nutritious and easy of assimilation. Not only is it repulsive to the palate, but it is probably difficult of digestion.

The **liver** of the pig, the calf, and the lamb is largely consumed as human food. Its richness and

digestion. Of all these, the young well-fed domestic fowl or chicken is perhaps the most valuable to the invalid. The young partridge and hen pheasant yield also very delicate food. The pigeon has less flavour, and the large amount of fat in the duck and goose renders them unsuited for invalids.

Deprivation of the sexual organs at an early age is well known to add to the size, flavour, tenderness, and edible qualities generally of certain poultry, as is well seen in the capon and poulard.

The flesh of **game** contains less fat than that of poultry, and has a finer flavour. It is tender and easy of digestion. Keeping develops the flavour of game, as is especially notable in grouse. The absence of fat and the finer flavour will often commend it to invalids in preference to poultry. Snipe, quail, and woodcock are delicate in flavour, but they are too rich for invalids. Game for invalids should only be kept long enough to secure tenderness, and the breast is the most suitable part for them to eat. Wildfowl generally have close and firm flesh, of strong and often fishy flavour, not suited to the digestion of invalids.

The flesh of a young **hare** is short-fibred, very tender, and of excellent flavour; it is nearly as digestible as chicken, but more stimulating.

The flesh of the rabbit when young is fairly digestible, but when older it becomes dry and hard in cooking, and cannot be said to be easy of digestion.

The following table presents the composition of several kinds of fowl :—

	Water.	Albuminates.	Fat.
Fat chicken	70·03	23·32	3·15
Fat goose	38·02	15·91	45·59
Partridge	71·96	25·26	1·43

cutaneous affections, but this is doubtful. In Siberia dried fish ground into powder is made into a kind of bread.

Fish is considered to be less satisfying and less stimulating than the flesh of birds and mammals; it appears to be digested more rapidly, and therefore requires to be taken at shorter intervals or in larger quantity. For these reasons it forms an especially useful food for invalids whose digestive powers are unequal to cope with the stronger kinds of animal food.

Other white-fleshed fish, besides the sole and whiting, and containing but very little fat, are the turbot, brill, cod, plaice, flounder, etc.

In the salmon, the type of red-fleshed fish, there is, as the above table shows, a much larger proportion of fat, which is interspersed amongst the muscular fibres and accumulated under the skin. It is most abundant in the thinner abdominal part of the fish.

The pilchard, sprat, herring, and mackerel, as well as the eel, contain much fat mixed with their flesh, and these fish are, on that account, unsuited to persons with delicate digestions.

The flounder, like the sole and whiting, is light and easy of digestion, and has a delicate flavour if cooked very fresh. Cod and haddock are not very easy of digestion; the former varying greatly in quality, and sometimes being hard and tough. When cod is in season, there is a white curdy matter found between the flakes after boiling; this consists of coagulated albumen, and is absent when the fish is out of season.

Turbot is a fine-flavoured fish, and its flesh is firmer and richer than that of the sole, etc. Brill resembles turbot, but is of inferior flavour.

Louis Agassiz spoke of fish as a food "refreshing to the organism, especially after intellectual labour; not that its use can turn an idiot into a wise or witty man, but a fish diet cannot be otherwise than favourable to brain development."

The presumed aphrodisiac effect of a fish diet we are disposed to think not without a basis of experience. There is a remarkable passage in Montesquieu's "Esprit des Lois" on this point. "The founders of the religious orders," he says, "who desired to subject their unhappy victims to the impracticable law of chastity, wholly missed their end in prescribing for them the habitual use of fish."

Crustacea and mollusca (shell-fish).—Many of the *crustacea* are highly popular as articles of diet—the lobster, crab, crayfish, shrimp, and prawn especially. They are, as their composition shows, highly nutritious, but they have also the reputation of being very indigestible; indeed, in many persons, some of them, the lobster and crab in particular, give rise even to toxic symptoms, such as nausea, vomiting, diarrhœa, giddiness, and frequently to cutaneous eruptions of an erythematous nature. The rheumatic and gouty are considered to be peculiarly prone to such attacks. The following is Payen's analysis of the different parts of a lobster:—

	Flesh.	Soft internal substance.	Spawn.
Water	76·618	84·313	62·983
Nitrogenous matter	19·170	12·140	21·892
Fatty matter	1·170	1·144	8·254
Saline „ (ash)	1·823	1·749	1·998
Non-nitrogenous (ash) and loss	1·219	0·354	4·893

The oyster is the chief of the edible MOLLUSCA. In England the mussel, scallop, cockle, periwinkle, whelk, and limpet are also eaten.

The **oyster,** when in season and eaten raw, is esteemed a very digestible form of food; but when cooked, it is by no means easy of digestion.

Analysing the whole contents of the oyster shell, König and Krauch found it to contain:—Water, 89·69 per cent.; albuminates, 4·95; fat, 0·37; and extractives, 2·62.

The oyster consists chiefly of a soft and a hard portion. The soft part is the liver; this is very digestible. The hard part is the muscle that binds the shells together, and is not nearly so digestible, and should not be given to invalids of weak digestion.

The digestibility of the oyster, according to Dujardin-Beaumetz, is due to the fact that "its edible part consists almost exclusively of liver;" when this is crushed, the hepatic cells are set free and "the glycogen is brought into contact with the hepatic ferment, so that a veritable auto-digestion of the liver takes place. The digestion of the oyster, therefore, makes but little demand on the stomach digestion. But if its digestibility is great, its nutritive value is small . . . for ten dozen oysters would be required to yield the nitrogenous substances needed in a day's ration."

Oysters vary greatly in delicacy of flavour; some are large and coarse; others, like the "native," small and delicate.

The **mussel** is a nutritious bivalve, the consumption of which is chiefly confined to the poorer classes of seaport towns. They are usually cooked in their own liquor, and vinegar is added. This mollusc has an evil reputation for causing toxic symptoms, often of great severity. This is said to happen more frequently

Milk and its derivatives—cream, butter, cheese, etc.—Eggs.—It will be necessary to consider at some length the properties of that very important animal food—milk—a food which is remarkable as containing all the alimentary substances required for the support and maintenance of animal life, and which is, on that account, termed a *complete* or typical food. The only other *complete* food afforded by the animal kingdom is eggs. We shall therefore consider the food qualities of eggs also in this section.

Not only does milk form the exclusive food, for a time, of the young of all the mammalia, but it is also capable of being advantageously employed as the chief food for adults under various circumstances, which will be fully considered in the second part of this work.

In milk we find the four classes of alimentary substances necessary for health combined in proportions well adapted for the period during which growth is active; but when applied to the feeding of adults, the proportions of albuminates and fat are in excess as compared with the amount of sugar.

The percentage composition of good cow's milk is thus given by Parkes:—

	Specific Gravity, 1029 and over.
Water	86·8
Albuminates	4·0
Fats	3·7
Carbo-hydrates	4·8
Salts	0·7

The albuminates consist of casein and a small quantity of serum, or true albumen, which remains in solution after the casein is thrown down. Cow's milk is said (Parkes) to contain as much as 5·25 grammes of albumen per litre. Casein, the chief nitrogenous constituent of milk, differs from albumen in not being coagulated by heat; but it is readily coagulated by

The *salts*, together with the water of milk, supply the necessary inorganic substances required for the nutrition of the animal organism.

Potash salts are more abundant in milk than soda salts; and calcium phosphate is a considerable and important constituent, as it is needed for the bone formation of young animals. These salts are chiefly in the form of chlorides, phosphates, and sulphates.

The amount of salts in cow's milk varies, especially with the animal's food, from 0·5 to 0·8 per cent.; the normal average is 0·7 to 0·75. In poor milk it may be as low as 0·3 per cent.

The total amount of *solids* in cow's milk, of an average specific gravity of 1030, is 13·2 per cent., and a pint (or 20 oz.) of such milk will contain in round numbers—

	350	grains of Casein,
	324	„ „ Fat,
	420	„ „ Lactose,
and	66	„ „ Salts.
Total . .	1,160	grains, or more than 2½ oz. average of water-free food.

If an adult requires daily 23 oz. of water-free food, it would take 9 pints of milk of a specific gravity of 1030 to supply this; but such a quantity of milk would give a considerable excess of albuminates and fat, and a very great excess of water; and although this excessive proportion of water and fat is essential for the rapid growth and due elimination of the young, it would be a wasteful food for an adult. So that it is not a food well suited for the nourishment of adults, unless mixed with other foods, which should consist chiefly of carbo-hydrates.

It has, however, been suggested that it might prove a valuable food in old age, and remedy the

The milk of the sheep is rarely used as human food, and therefore has less interest for us. It is particularly rich in casein and butter. The milk of this animal, as well as that of the goat, would seem, according to the second table, to have much of its nitrogenous matter in the form of albumen, which is there estimated separately.

But if we confine our attention to the first table we shall notice that whereas human milk and ass's milk each contain about the same proportion of casein, cow's milk contains nearly three times, and goat's milk more than four times as much casein (or nitrogenous matter, *i.e.* casein and albumen together) as human milk.

On the other hand, human milk and ass's milk are richer in sugar than cow's or goat's milk; human milk being especially rich in lactose. Human milk is also rich in butter, considerably more so than the milk of the cow or the ass, but not so rich in this ingredient as that of the goat. Of the four milks compared together in the first table, goat's milk is richest in solids, and contains the largest proportions of nitrogenous and fatty constituents, as well as of salts; but it is comparatively poor in sugar. It also contains a peculiar smelling acid (hircin or hircic acid). It is the most highly nutritious of these milks, but it is the least digestible.

Ass's milk, on the contrary, contains the smallest amount of solids, but is rich in sugar, although not quite so much so as human milk. It is poor in casein and in fat, resembling human milk in all but the latter particular. Ass's milk is, therefore, light, sweet, and easy of digestion, and is a most useful food for persons whose stomachs are too delicate to digest cow's milk easily. It is said to occasionally give rise to diarrhœa.

If we now glance at the second table we shall

considerable influence over the amount and quality of the milk. A poor diet soon leads to a diminution of the solid constituents. Fresh green pastures in the country produce the sweetest-flavoured and best milk. Beet-root and carrots increase the amount of sugar. Turnips, brewers' grains, etc., impart a peculiar flavour. The colour, the odour, and even poisonous properties may pass from the vegetables or plants consumed into the milk secreted. In autumn it is desirable, on this account, that cows should not be allowed to eat a quantity of dead leaves which may be scattered over their pastures.

It is a familiar experience that wet-nurses have to be careful in their diet or their milk will excite intestinal disorders in the infants they are suckling: medicines, also, taken by nurses will through their milk influence the infants. It is possible to take advantage of this circumstance, and so administer *medicated* milk to sucking infants; in this way iodides, preparations of mercury, salicylic acid, arsenic, quinine, and other substances, may be carried with the milk from the nurse to the child.

The frequency with which contagious diseases are communicated by milk necessitates great care in its collection and storage.

Excessive physical exertion and morbid mental states are also known to injuriously affect the properties of the milk secreted under such conditions.

We have already incidentally alluded to the fact that milk undergoes a particular *change* when it is allowed to stand for a certain time, the length of which varies according to the temperature to which it is exposed. This *spontaneous coagulation* of milk is due to the production of *lactic acid*, which is formed, as we have shown, from the *lactose* of the milk by the action of a ferment (*bacillus acidi lactici*) introduced from without. It is the casein in the milk which

gravity than the rest of the fluid. The average specific gravity of cow's milk may be taken as 1030, but it varies somewhat. Its reaction is neutral or slightly alkaline, but not long after removal it may be found faintly acid.

The specific gravity is ascertained by the hydrometer or lactometer; it is usually found to vary between 1026 and 1034. The addition of water lowers the specific gravity, and therefore a low specific gravity is one of the indications of adulteration with water; but it is necessary to remember that, owing to the lightness of fatty matter, an excess of cream also lowers the specific gravity. A specimen of milk containing 26 per cent. of cream has been found to have a specific gravity of 1019, and one with 80 per cent. of cream a specific gravity of 1008. These specimens when skimmed had a specific gravity of 1027 and 1026 respectively. Milk with a specific gravity of 1026 or 1027 *unskimmed*, will when *skimmed* often have a specific gravity of 1030 or 1031. It is advisable then to skim the milk before taking its specific gravity, and if it is found of a lower specific gravity than 1027 or 1028 it is highly probable that it has been watered.

In order to estimate the amount of *cream* in a given specimen of milk, a *creamometer* is employed; this consists of a long glass tube graduated to 100 parts; this is filled with milk, and then placed in a protected spot for twenty-four hours. The cream rises as a more or less thick layer to the top, and the number of degrees it occupies can be read off. About 8 per cent. is the average. If it falls below 5 per cent. it is probable that the milk is adulterated with water. In some very rich milks it may be as much as 20 per cent.*

* Full details for the examination of milk will be found in Parkes's "Hygiene," and in other works dealing with the analysis of food.

Cream varies somewhat in composition according to the quality of the milk from which it is obtained, and the method adopted of obtaining it. The following table shows approximately its composition:—

	Letheby.	Bauer.
Water . . .	66·0	Varies from 22·0 to 83·0
Albuminates . .	2·7	" 2·2 " 7·4
Fat	26·7	" 8·2 " 70·2
Lactose . . .	2·8	" 0·74 " 4·5
Salts . . .	1·8	——

Clotted or Devonshire cream is solid, not fluid like ordinary cream. The milk from which it is collected is previously heated just to the point of simmering. It is then allowed to stand and cool, and the fatty matter rises to the surface together with a coagulated scum, which *clots* the cream. It is richer and less digestible than fluid cream.

Curd and **Whey.**—It has already been stated that when an acid, or when rennet, is added to milk, the casein coagulates and forms the so-called *curd* of milk, from which cheese is made, and the fluid from which it separates is termed *whey*.

Rennet coagulates milk with an alkaline reaction, and forms what is called "sweet whey." In this process the casein is decomposed into the precipitated cheese and the slightly-soluble whey-albumen. It is a process quite distinct from the coagulation of milk by the gastric and pancreatic juices, or from that produced by other acids out of the body.

The *curd* consists of casein with some milk globules entangled in it. The *whey* contains some soluble albumen and fat, and a great proportion of the salts and lactose, together with some lactic acid.

Koumiss.—Milk can be made to undergo alcoholic fermentation by the conversion of its lactose into alcohol and carbonic acid.

Advantage has been taken of this property in certain countries to produce an alcoholic drink from milk. The Kirghis tribes and the Tartars, who dwell in the immense plains surrounding the Caspian Sea, utilise mare's milk for this purpose, and prepare from it an alcoholic beverage which is known as koumiss. There are two or three qualities prepared of varying strength.

The following comparison of the composition of mare's milk and koumiss is quoted from Hartier by Dujardin-Beaumetz :—

In 1000 parts.	Mare's Milk.	Koumiss.
Albuminates . . .	19 to 28	11·20
Fatty Matter . . .	12 „ 15	12·00
Lactose	53 „ 57	22·00
Lactic Acid	—	11·50
Carbonic Acid . . .	—	7·85
Alcohol	—	16·50
Salts (Ash)	0·280	0·28

A form of koumiss is also prepared in England from cow's milk.

It is a valuable food in the dietetic treatment of phthisis and other diseases.

Kefyr is another fermented drink, prepared in the mountains of the Caucasus from cow's milk. This fermentation is brought about through the agency of a micro-organism, the *Dispora caucasica*, which is added to the milk, and it possesses the property of converting the lactose into alcohol and carbonic acid.

As cow's milk contains proportionately much less sugar than mare's milk, *kefyr* therefore contains less alcohol than koumiss.

Butter.—Butter is one of the most digestible of animal fats, and one of the most agreeable and delicate in flavour.

It is obtained, as is well known, by the process of churning cream or milk, which causes the fat globules to run together and coalesce into a solid mass.

It is rarely made from any but cow's milk, which alone yields butter of the pleasant delicate flavour so generally appreciated.

The butter, when formed, is well washed and kneaded with water, for the purpose of freeing it, as completely as possible, from adherent casein and the other constituents of milk. The more completely this is done, the better will the butter keep. It is usual also to add a certain proportion of common salt to aid in its preservation; this varies in amount according to whether the butter is to be consumed "fresh" or "salted."

König gives the composition of good butter as :—

Fat	87·0
Casein	0·5
Milk Sugar	0·5
Water	11·7

Parkes gives the water as varying from 5 to 10 per cent.; when purposely mixed up with butter to increase its weight, as much as 23·6 per cent. of water has been detected in fresh, and 28·5 in salt, butter.

Such large admixtures of water can be detected by *melting* the butter, when the water will collect below the oil.

All butter contains a small amount of casein which is taken up from the milk; the best butter contains the least. The changes in butter which render it *rancid* are apparently dependent on alterations in the casein, which acts as a ferment and liberates fatty acids. The more completely, therefore, the casein is removed from it, the better will the butter keep.

it remains for some time to *ripen.* In this *ripening* process the fats increase at the expense of the casein, and volatile fatty acids are developed, which impart to the cheese its characteristic odour and flavour. The richer the cheese in fat, the more highly flavoured it is capable of becoming. These fermentative processes may go on to actual putrefaction, and even poisonous ptomaines may be developed; or vegetable organisms in the form of mould (*Aspergillus glaucus*, blue and green mould, and *Sporendonema casei*, red mould) may appear in it, as well as a microscopic animal, the *acarus domesticus*, or cheese mite.

There are a great many varieties of cheese. In the first place, there is the so-called "fresh," or "sour-milk," cheeses, as they are sometimes termed, such as our own cream cheeses. These are not intended to be kept, but to be eaten as soon as made. "When cheese is made from sour milk, the milk is gently warmed to about 50° C., in order to obtain a firmer coagulation of the casein. The whey is then pressed out, and the resulting sour-milk cheeses are generally eaten fresh." (*Bauer.*)

Cheeses, however, that are intended to be kept are made from fresh milk.

The quality and character of the several varieties of cheese depend to some extent upon whether they are made from *skimmed* or *unskimmed* milk, or from *milk* to which *cream* is added.

The richer cheeses as Stilton and Double Glo'ster, contain a considerable amount of added cream. The best quality Cheshire is made from *unskimmed* milk; the second quality Chester, Glo'ster, and many American are made from milk, some of the cream of which has been removed. Dutch and Parmesan cheese and some of the poorer qualities made in many counties in England, are made from *skimmed* milk.

The poorer cheeses keep best, but become very

palate. Cheese with bread forms a popular, convenient, and highly nutritious diet for the labouring poor. When taken at the end of a meal by the opulent classes, it is rather as a condiment than a food, especially when highly flavoured and in a state of advanced decomposition, as, for example, old Stilton and Gorgonzola.

Cheese is popularly regarded as a food difficult of digestion, but this has, doubtless, been much exaggerated. The poorer harder kinds of cheese, which contain a large proportion of casein, are certainly difficult to digest, but the richer, softer, finer-flavoured, and less compact cheeses by no means merit this reproach, and may, in small quantity, promote the digestion of other food by, as Pavy has maintained, "its stimulant action on the stomach."

Eggs.—Eggs form another *complete* food, like milk. They contain all the elements of the blood, and the organism of the young chick is developed from them. But when regarded in the light of a complete food the shell must be taken into account, for it is from the shell that certain essential constituents of the organism of the chick is obtained. In the process of incubation the earthy salts in the shell are dissolved by phosphoric acid, which is developed by the oxidation of phosphorus, and they are thus in a condition to be absorbed. Eggs therefore provide us with a highly nutritious food in a concentrated form.

The egg of the domestic fowl is the one chiefly utilised for human food, but those of the duck, goose, turkey, and guinea-fowl are occasionally eaten. Plovers' eggs are greatly esteemed for their delicacy of flavour. The eggs of all birds have the same composition, and are suitable for food, but their quality and flavour depend greatly on the food of the bird which yields them.

It is here seen that the *yolk* differs from the *white* chiefly in its greater richness in solids, especially in fats, and in the presence of pigment. The saline constituents are the same as those found in the blood; the *white* has an excess of chlorides, the *yolk* an excess of phosphates.

The *yolk* is of more importance than the *white* from an alimentary point of view, as it contains a quantity of fat as well as a peculiar form of albumen, whereas the *white* is chiefly a simple solution of albumen. In some persons certainly, if not in all, white of egg, if taken uncooked in large quantities, gives rise to albuminuria, but the slightest amount of cooking is said to prevent this.

Eggs are an easily digested food if taken raw or lightly cooked, but if cooked so as to be *hard* they are difficult of digestion. Some persons present the peculiarity of being unable to take eggs in any form or in the smallest quantity without manifesting toxic symptoms.

Eggs may be preserved for a long time by various devices which are intended to prevent the entrance of air through the porous shell.

Eggs are extensively employed in ordinary cookery, as well as in the diet of the sick, and it has been said that they can be prepared in "more than five hundred different ways." *

The yolk of egg is considered unsuitable in the *uric acid* diathesis because of the amount of *lecithin* it contains, and eggs are altogether forbidden by many physicians in albuminuria.

The well-known *lait de poule* is made by beating up the yolk of egg in hot water, and adding sugar and some aromatic flavouring substance, such as orange-flower water; sometimes a little rum or cognac is added.

* "L'Hygiène de l'Estomac," par Dr. E. Monier.

The following table of the various constituents of the ash of the most important animal foods is taken from Bauer :—

We may call attention to the richness of animal flesh in potassium and in phosphoric and sulphuric acids, and its comparative poorness in sodium, calcium, and chlorine ; to the richness of milk in calcium and chlorine ; and to the richness of eggs in sodium, iron, and phosphoric acid.

CHAPTER IV.

VEGETABLE FOODS.

We derive from the vegetable kingdom a great variety of foods, many of them of a highly nutritious character, and therefore of great importance to the human race.

The foods obtained from the vegetable kingdom, like those derived from the animal world, contain both albumen and fat, but, as a rule, in vegetable foods the non-nitrogenous constituents are greatly in excess of the nitrogenous ones, and occur chiefly as carbo-hydrates; and, save in the case of certain fruits and seeds, they contain but little fat.

The remarkable difference in these respects between animal and vegetable food is well shown in the following table from Hofmann :—

	Nitrogenous Constituents.	Fat.	Carbo-hydrates.	Salts.
Fat Beef .	51·4	45·6	—	3·0
Lean „ .	89·4	5·5	—	5·1
Pea Flour .	27·3	0·8	68·9	3·0
Wheat . .	16·6	0·9	81·9	0·6
Rice . .	7·7	0·4	91·2	0·7

Vegetable foods differ further from animal foods in being less digestible and less capable of complete assimilation by the digestive organs of man.

There are several modifications of albuminates found in vegetable as well as in animal food.

1. There is *vegetable albumen* which separates from vegetable juices by coagulation when heated, and then presents a close resemblance to egg albumen both in properties and composition.

the fact that they contain oxygen and hydrogen in the proportion to form water. Of these *starch* is the most important. It abounds in all plants, and especially in the seeds of the cereália and leguminosæ, and in the potato and other tubers. By the action of certain reagents, and also by that of some of the digestive ferments, the insoluble starch is converted into soluble *dextrin*, and ultimately into grape sugar.

Similar properties are possessed by *inulin* and *lichenin* (from Iceland moss), and the various kinds of gum and mucin.

Cellulose, which exists in abundance in all plants, is closely allied to starch, but it is only capable of serving as human food when quite young and tender. It tends quickly to become "woody," and is then not only itself incapable of digestion by man, but it hinders the digestion of the other constituents associated with it.

Other important *carbo-hydrates* found in vegetables are the different kinds of sugar: they are not only nutritious in themselves, but they are most valuable from the property they possess of giving an agreeable flavour to other foods.

Grape sugar is found in the juices of most sweet fruits. *Cane* sugar is much sweeter and is found in the sugar-cane, certain species of maple, beet-root, etc. Fruit sugar, melitose, inosite, and mannite, are varieties of sugar possessing little importance as food; the same remark applies to *pectin* or fruit jelly, to the vegetable acids, and the glucosides.

The most important vegetable foods are derived from those plants which produce *farinaceous* seeds, *i.e.* seeds yielding *meal* or *flour*. The seeds of the *cerealia*, one of the *grass* tribe, and of the *leguminosæ* or *pulse* tribe, are of the greatest value and usefulness in this respect.

To the former belong those well-known "grains,"

exhibits the relative average composition of the more important cereal grains :—

	Nitrogenous Substances.	Fat.	Starch, Sugar, Gum, etc.	Cellulose.	Ash.	Water.
Wheat .	12·42	1·70	67·89	2·66	1·79	13·56
Rye .	11·43	1·71	67·83	2·01	1·77	15·26
Barley .	11·16	2 12	65·51	4·80	2·63	13·78
Oats .	11·73	6·04	55·43	10·83	3 05	12·72
Maize .	10·05	4·76	66·78	2·84	1·69	13 88
Rice .	7·81	0·69	76·40	0·78	1·09	13·23

Oats, it will be seen, are especially rich in fatty and mineral substances, and also in indigestible cellulose. Maize also is relatively rich in fat, but slightly deficient in salts. Barley contains more fat, more indigestible cellulose, and more salts than wheat, but less nitrogenous substances and less digestible carbo-hydrates. Rice is seen to be rich in starch, but defective in nitrogenous and, indeed, in all the other solid constituents.

The next table gives the composition of different kinds of *flour*, and shows also the difference in composition between the finely and the coarsely ground flours :—

The usual yield is about 80 per cent. of flour, 16 of bran, and 4 of loss.

The flour is divided into different qualities, according to its fineness, the third or coarsest quality being known as *pollards* or *bran-flour*.

STRUCTURE OF GRAIN OF WHEAT (× 200).
a, Cells of the bran; *b*, cells of thin cuticle; *c*, gluten cells, *d*, starch cells.

The *hard* wheats yield a flour richer in gluten than the soft ones, and therefore more nutritious.

The gluten cells are especially accumulated in the inner portion of the cortical layer, which is richest also in fat and salts, and this part of the grain has, on that account, a high nutritive value.

The accompanying figure* illustrates these points in the structure of the wheat grain.

* From Landois' "Text-book of Human Physiology," 3rd edit., p. 351.

granular preparation of wheat. *Macaroni, vermicelli,* and *pâte d'Italie* are made from hard Italian wheats rich in gluten.

Barley.—The meal of barley is very nutritious, and is largely used in fattening animals. The Greeks and Romans trained their athletes on barley (*hordearii*). It is rich in nitrogenous substances, which consist of gluten-casein, gluten-fibrin, mucedin, and albumen. It is especially rich in iron and phosphoric acid. It is not so well suited for making bread as wheat flour; the bread is heavier, less digestible, and is said to be rather laxative.

Scotch or *pot* barley consists of the grain without the husks. *Pearl* barley is merely the grain deprived of husk, and rounded and polished.

Barley bread is usually made of a mixture of wheat-flour with barley-meal.

Pearl barley is much used for making barley-water, a slightly nutritious beverage much used in sickness. Barley is largely used in the preparation of *malt.*

Oats.—Oatmeal is a highly nutritious food. As will be seen by reference to the preceding tables, both the grain and the meal are rich in nitrogenous substances and also in fat.

Oatmeal, according to Bauer's table, contains 14·29 per cent. of nitrogenous substances, and 5·65 per cent. of fats. It is therefore the richest of all the cereal meals in both these alimentary principles. Gluten-casein, or *avenin,* forms a considerable part of the nitrogenous constituents. This is closely related to the *legumin* of peas and beans. Dujardin-Beaumetz, who, in conjunction with M. Hardy, made an examination into the value of oatmeal as a food for growing children, has published the following analysis, which differs somewhat from that of Bauer, and gives a still larger percentage of fat:—

dyspeptic symptoms, which disappear on discontinuing its use.

Rye.—Rye is much consumed on the Continent, especially in parts of Russia and Germany. The grain, which has a close resemblance, in outward aspect, to wheat, is white internally, but brown on the outside, so that rye-meal makes a "black" bread. It is equal to wheat in nutritive value, but contains less vegetable fibrin and more casein and albumen. It also contains a peculiar odorous substance, and makes a sour-tasting, dark bread, which often disagrees with persons unaccustomed to its use and causes diarrhœa.

Rye is, of all the cereals, the grain most liable to be affected by "ergotism" due to the attack of a parasitic fungus. *Ergotised* or *spurred rye* causes, when taken as food, poisonous symptoms, the most serious of which are convulsions and gangrene.

Maize.—Maize is highly nutritious, and most analyses agree in attributing to it the largest proportion of fat of all the cereals; but, as will have been noticed, Bauer, in the tables given above, ascribes to oats a still larger proportion of fatty constituents.*

Maize (Indian corn) is now extensively cultivated in Europe, and its flour is largely substituted for that of wheat. It has, however, a peculiar flavour not approved of by many. In the green and succulent state the grains are cooked in North America as a fresh vegetable, like green peas.

Hominy is a preparation of maize. Owing to its deficiency in gluten, maize-meal is ill adapted for making bread unless mixed with some wheaten or rye flour; but it is often made into cakes, like oatmeal, which are palatable and nutritious, such as the

* The older tables of Letheby, quoted by Pavy, give to maize-meal 8·1 per cent. of fatty matter, and to oatmeal 5·6; and those of Payen 8·8, as compared with 5·5.

renders it a very suitable food for persons with an irritable intestinal mucous membrane.

It cannot, by itself, be made into bread, but it is often mixed with wheat flour to make a very white bread, and it is frequently made into cakes with the help of adhesive substances.

It should not be boiled, but thoroughly *steamed* when cooked by itself, as boiling removes some of the small amount of nitrogenous and saline matters it contains, and so further lessens its food value.

The following table taken from the sixth edition of Parkes's "Hygiène," gives the comparative richness of the preceding *grains* in the various alimentary principles :—

Nitrogenous Substances.	Fat.	Starch, etc.	Salts.
Wheat.	{ Maize.	Rice.	Barley.
Barley.	{ Oats.	Maize.	Oats.
Rye.	Barley.	Wheat.	Wheat.
Oats.	Rye.	Rye.	Rye.
Maize.	Wheat.	Oats.	Maize.
Rice.	Rice.	Barley.	Rice.

Millet, sorghum or durrha, buckwheat.—A few other grains of subordinate value, such as those just-named, are employed as food in different countries.

Millet (*Panicum miliaceum* and other genera of grasses) belongs to the Cerealia ; it is largely consumed on the West Coast of Africa, in Algeria, in some parts of China, India, and the South of Europe.

The composition of millet is thus given by König (excluding *cellulose*) : Water, 12·3 ; albuminates, 11·3 ; fats, 3·6 ; carbo-hydrates, 67·3 ; salts, 2·3. The ash contains much silica and phosphates. As might be inferred from its composition it makes a good nutritious bread.

combination with rice they form the staple food of many Indian races. Eaten also with animal fat (bacon and beans) they constitute a highly nourishing food. They are especially useful when much exercise is taken; and both men and animals can subsist upon them alone for long periods.

Their defects as compared with the cereals are their relative indigestibility, their unsuitability to bread-making, and their less agreeable taste. "About 6·5 per cent. of the ingested pea passes out unchanged, and starch cells giving a blue reaction with iodine are found in the fæces; much flatus is also produced by the hydrogen sulphide formed from the legumin." (*Parkes.*)

The following table shows the mean composition of the pulses as compared with that of wheat (*Bauer*):—

	Water.	Nitrogenous Substances.	Fat.	Starch, etc.	Cellulose.	Ash.
Wheat .	13·56	12·42	1·70	67·89	2·66	1·79
Beans .	13·60	23·12	2·28	53·63	3·84	3·53
Peas .	14·31	22·63	1·72	53·24	5·45	2·65
Lentils .	12 51	24·81	1·85	54·78	3·58	2·47

Landois' estimate differs somewhat from the preceding.* "Peas," he says, "contain 18·02 proteids and 34·81 starch; beans 28·54 and 37·50; lentils 29·31 and 40;" and he adds, "on account of the large amount of proteids they contain, they are admirably adapted as food for the poorer classes."

Beans.—There are several varieties of beans used as food: there is the common horse bean, grown in the fields, and the Windsor or broad bean grown in gardens; the latter contains more starch, less cellulose, and rather more fat than the former. Then there is

* "Physiology," 3rd edition, p. 351.

Professor Beneke has suggested, as an excellent food for invalids, fine lentil flour combined with a certain proportion of rye flour, so as to increase the relative amount of starch.

It is necessary to bear in mind that the dry leguminous seeds require careful and thorough cooking. It is best to soak them for some time in cold rain water, and then boil them slowly in water free from chalk, as lime salts form insoluble compounds with legumin.

Roots and tubers.—The various roots and tubers employed as food are valuable chiefly on account of the amount of starch they contain; they are vastly inferior in nutritive value to the cereals and pulses, as they contain a relatively large amount of water and a comparatively small proportion of albuminates. Many contain a considerable quantity of sugar as well as starch, and also some *pectin* or vegetable jelly. Some contain vegetable acids, chiefly combined with potash, and these salts give them their well-known and important anti-scorbutic properties.

The **potato.**—This tuber, or swollen underground stem of the *Solanum tuberosum*, is the most important of these foods. It is a very productive vegetable, and therefore well repays cultivation, and when cooked forms a palatable and easily digested food. It is not, however, fit to be made the exclusive food of a people, as was the case some years ago in Ireland, when it was calculated that the potato formed from three-fourths to four-fifths of the entire food of the Irish people, and that an adult Irishman consumed 10½ lb. of potatoes daily, or 3½ lb. to each meal.

Since the outbreak of the potato disease, and the famine in Ireland which followed as a consequence, Indian corn has been largely cultivated in its place.

The average percentage composition of the potato

feeble digestions. The value of the potato as a preventive of scurvy has been referred to; and it is therefore a useful vegetable to be taken on long sea voyages.

The quality and flavour of potatoes vary greatly with soil and season; those are best that are grown on sandy or readily permeable soils. They are injured by long *keeping*, by *frost*, etc.

The **sweet potato,** from the *Batatas edulis*, has a tuber rich in starch (16 per cent.) and sugar (10 per cent.), and used to be eaten, like the ordinary potato, in Europe before the introduction of the latter. It becomes mealy when boiled, and is a wholesome and useful food, but too sweet to eat with meat as a vegetable. It is largely eaten by the poorer classes in some parts of America, and also in the south of France and Spain.

The **yam,** the large tuber of the *Dioscorea batatas* and other species, is a good substitute for the potato, as it cooks "mealy," and forms a wholesome and agreeable food. It contains a large amount of starch, and has not the objection of being sweet like the sweet potato. It is largely consumed in some tropical countries, and is also cultivated in parts of Europe.

The **Jerusalem artichoke** is a well-known edible tuber, grown in most vegetable gardens in England. It has a sweet taste and remains watery after cooking, and does not become mealy like the potato; this is owing to its not containing starch. It is less digestible than the potato, and contains but very little nutritive substances, and is, therefore, practically of little importance as a food. It contains 14 per cent. of sugar, about 3 per cent. of nitrogenous substances, and about 2 per cent. of inulin, a principle isomeric with starch.

Arrowroot, derived from the tuber of the *Maranta arundinacea*, is a pure form of starch, highly

valued as an easily-digested carbo-hydrate. It is cultivated in the West Indies and other tropical countries. That imported from Bermuda is considered the best. Its "quality is judged of by its whiteness, by the grains being aggregated into little lumps, and by the jelly being readily made, and being firm, colourless, transparent, and good-tasted. The jelly remains firm for three or four days without turning thin or sour; whereas potato-flour jelly in twelve hours becomes thin and acescent. Under the microscope the starch-grains are easily identified," * and any adulteration with sago, tapioca, or potato-starch can thus be detected.

Arrowroot is simply a pure starchy food, and is valuable as a bland unirritating carbo-hydrate for invalids. It is usefully mixed with clear meat soups and extracts.

Tous les mois is another pure form of starch, derived from the tuberous *root* of the *Canna edulis*, grown in the West Indies. It is of the same value and use as arrowroot. Its starch granules have beautifully marked and distinct concentric lines, and exceed those of all other starches in size.

Tapioca, also a pure starch, is obtained from the tuberous roots of the *Manihot utilissima*, cultivated in Africa, India, and other hot countries. Its starch grains are small, with a central hilum, and three or more often adhere together into compound grains.

It is an agreeable and easily-digested carbo-hydrate, beneficial both for invalids and the healthy. It is usefully added to meat soups and broths, or made into puddings with milk.

Sago is another starch, obtained from the pith of the stems of several species of palm. It is usually met with in the "granulated" form or "pearl sago," small spherical grains prepared by mixing sago-flour

* Parkes.

with water into a paste, and then granulating. It is used like tapioca for making light puddings and for adding to soups, and is a useful and easily-digested food for invalids and dyspeptics.

Salep, consisting chiefly of starch and mucilaginous matter, is derived from the tubercles of several species of orchids, and is imported into England from the East. It possesses nutritive and soothing properties.

The following "roots" are of a more *succulent* nature, and are commonly used as *fresh* vegetables.

The **carrot** is the root of the wild *Daucus carota* improved by cultivation. When young it forms a useful and wholesome food, and is at Vichy regularly served at breakfast to the invalids who are taking the waters there. It contains a large proportion of water, 85 to 88 per cent., and about 8 per cent. of carbo-hydrates, including a variable quantity of sugar, 1 per cent. of salts, and rather more than 1 per cent. of albuminates.

The **parsnip** is much less frequently eaten than the carrot, which it closely resembles in food properties and composition, containing like it a considerable amount of sugar. A wine is sometimes made from parsnips.

The **turnip** is one of the cabbage tribe. It is a very popular vegetable, and the roots are largely cultivated as food for cattle. Its nutritive value is small, on account of the large proportion of water, 91 per cent., it contains. It contains about 6 per cent. of carbo-hydrates (starch, sugar, etc.), and about 1 per cent. of nitrogenous substances. It would probably be more popular as a vegetable on account of its agreeable flavour were it not for its tendency to cause flatulence.

Beetroot is a most valuable vegetable. It is extensively cultivated as food for cattle, and for the

cellulose offers great resistance to digestion, and they are quite unsuited to persons of feeble digestive powers. On the other hand, the indigestible residue left by all green vegetables affords a useful and wholesome stimulus to intestinal contraction, and promotes regular action of the bowels.

By well-known arts of cultivation, the succulency and digestibility of many of these vegetables are greatly increased, especially by partial exclusion of light, and their value as articles of diet thereby greatly enhanced.

The cruciferous, or *cabbage*, tribe, is remarkable for the number of edible plants it contains. The natural order of the Cruciferæ is said not to possess a single poisonous plant, a botanical fact of great importance to those who happen to be in search of edible vegetables in a strange or unknown country. *Cabbages* (white and red), *greens*, *savoys*, *Brussels sprouts*, *cauliflower*, and *broccoli* are familiar examples. These contain a large proportion of sulphur, and therefore give rise during decomposition to a very disagreeable odour, and tend to occasion flatulence.

Sauer-kraut is a preparation of cabbage leaves, which are subject to pressure between layers of salt and allowed to undergo acid fermentation.

Cauliflower and **broccoli** consist of the *inflorescence* of the plant altered by cultivation. It is one of the most delicate and digestible of the cabbage tribe.

Seakale, which is grown excluded from light, and thereby *blanched*, is also delicate, nutritious, and easy of digestion.

Spinach is a wholesome and popular vegetable, and when properly cooked—*i.e.* made into a *purée*—is free from irritating properties. As it is, however, almost wholly indigestible, it acts as a useful aperient, and is for that reason prescribed as a remedy for

habitual constipation. Hence also its reputation for "clearing the complexion." There exists a very old French proverb to this effect :—

> "Par l'espinard et le porreau,
> Florit le lys clair de la peau."

Sorrel is used largely in France, much in the same way as spinach is used in Great Britain. It is peculiar in having an acid taste, due to the presence of acid oxalates, and on that account it is considered as prejudicial to those who have any tendency to gout or gravel.

Celery is esteemed for its agreeable aromatic flavour, and is eaten both raw and cooked; in the latter form it is wholesome and digestible. It is by some regarded as aphrodisiac as well as carminative.

It also has a popular reputation as being a cure for rheumatism if cooked and eaten freely. "The celery should be cut into bits, and boiled in water until soft and the water should be drunk by the patient. Put new milk, with a little flour and nutmeg, into a saucepan, with the boiled celery, serve it warm with pieces of toast, eat it with potatoes, and the painful ailment will yield. The proper way to eat celery is to have it cooked as a vegetable after the manner above described." *

The **green artichoke,** a species of cultivated thistle, is of little importance as an article of food, it is considered rather as an agreeable delicacy, easy of digestion. It is said to contain some tannin as well as mucilaginous substances.

Asparagus.—This, one of the *Liliaceæ,* is a popular and delicate vegetable. It contains a peculiar crystalline principle *asparagin,* which possesses diuretic properties, and imparts a peculiar disagreeable odour

* *Garden Advertiser.*

to the urine. It has been reputed to act as a cardiac sedative, and to quiet palpitations; it has also been credited with aphrodisiac properties.

Lettuce, endive, watercress, mustard and cress, are salad vegetables, and are generally eaten raw. They are cooling, anti-scorbutic, and wholesome, and easy of digestion when the digestive organs are sound.

The **onion** is valuable both as a condiment and a vegetable. In the young green state it is added to salads to give them pungency, and the mature bulb is also extensively used for flavouring purposes. The larger species grown in hotter countries, as in Spain and Portugal, are of much milder flavour, and are eaten as an ordinary vegetable; they are wholesome and slightly laxative.

The **vegetable marrow,** although of delicate flavour and digestion, has very little nutritive value on account of the very large proportion of water it contains.

The **tomato,** largely used in salads and for the preparation of soups and sauces, is refreshing and appetising, and is valuable chiefly for its pleasant acid flavour. It is forbidden by many physicians to all those who have a tendency to gout or gravel, on account of its containing oxalic acid.

The **cucumber** is used chiefly as a salad, and young cucumbers (gherkins) are pickled in vinegar. They have an agreeable refreshing flavour, but the cucumber eaten raw is liable to cause gastric disturbance in persons of feeble digestion.

The following tables (after König) give 1st, the average composition of the chief succulent roots and green vegetables; also that of the *French bean* when eaten as a fresh vegetable, the pods and seeds together: and 2nd, the constituents of the ash of certain of these:—

Edible fungi.—Many species of fungi are suitable for food, but in England three only are commonly eaten—namely, the **mushroom,** the **truffle,** and the **morelle.**

Their chemical composition indicates a richness in nutritive, and especially in nitrogenous, substances, which should render them of considerable value as foods were they easy of digestion, but it seems doubtful if they are utilised in the alimentary canal. Some of them contain mannite and grape sugar amongst their non-nitrogenous constituents.

Mushrooms are largely consumed in England, but chiefly on account of their agreeable flavour; and they are eaten either alone or cooked with other kinds of food. They have the property of causing toxic symptoms, in certain persons, in the form of severe gastro-intestinal disturbance.

The *morelle* is usually imported from the Continent, and is employed chiefly for flavouring other dishes.

The *truffle* is esteemed a great delicacy, and is much employed in cooking, for its exquisite flavour. The black variety is the most highly valued, and those obtained from the oak-forests of Périgord in France are considered of the choicest flavour. They must be regarded as very indigestible vegetables.

The following is the chemical composition of the mushroom, truffle, and morelle as given by König. The ash is particularly rich in potash and phosphoric acid:—

	Mushroom.	Truffle.	Morelle.
Water	91·11	72·8	90·0
Nitrogenous Substances	2·57	8·91	3·48
Fat	0·13	0·62	0·24
Grape Sugar and Mannite	1·05	—	0·72
Other non-Nitrogenous Substances	3·71	7·54	3·95
Woody Fibre	0·67	7·92	0·67
Ash	0·76	2·21	0·94

The following gives the composition of certain dried fruits:—

	Apple.	Cherry.	Raisin.	Fig.
Water	27·95	49·88	32·02	31·20
Nitrogenous Matters .	1·28	2·07	2·42	4·01
Fat	0·82	0·30	0·49	1·44
Free Acid . . .	3·60	—	—	1·21
Sugar	42·83	31·22	54·26	49·79
Other Non-nitrogenous Matters . . .	17·0	14·29	7·48	4·51
Cellulose and Seeds .	4·95	0·61	1·72	4·98
Ash	1·57	1·63	1·21	2·86

The analysis of the ash shows these fruits generally to be particularly rich in potash salts. The apple and the strawberry are rich also in soda salts, especially the strawberry. They also contain salts of lime, magnesia, and iron.

It will be seen from the above tables that these fruits possess but a low nutritive value, as they contain a very large proportion of water, and of their solids only a very small proportion consists of nitrogenous matters. Their chief food value is in the sugar which they contain. This, in some, is considerable. They also contain important salts of vegetable acids (malates, citrates, tartrates) as well as some free acid.

They therefore possess valuable *anti-scorbutic* properties. As their salts are chiefly combinations of vegetable acids with alkalies, and as these become converted into carbonates in the system, they impart alkalinity to the urine, and they are, on that account, valuable in gouty states with a tendency to the deposition of acid urates.

Many contain small quantities of fat, and waxy and colouring matters. Their agreeable aroma is due

delicate flesh (when ripe) they are well suited to the gouty and diabetic.

Currants, gooseberries, bilberries, and raspberries are remarkable for the amount of *free* acid they contain, which makes them very refreshing, and their juices form an agreeable addition to effervescing water. The **mulberry** is also very refreshing, and has slightly laxative properties.

The **strawberry** is one of the most popular of fruits, and is very wholesome when taken in moderation. It is considered to be a useful food for the gouty on account of its richness in alkaline salts (potash, soda, and lime) and its cooling, diuretic, and laxative qualities. French authors maintain that its flavour is enhanced by the addition of some acid juice, such as orange or lemon juice, or a few drops of good vinegar.

The **grape** is a very important fruit, on account of its richness in sugar, both in the fresh and dried (raisins) form. It is very digestible when fully ripe, and most acceptable to invalids. Its properties will be fully discussed in connection with the grape cure.

The **melon** is perhaps the most watery of all the fruits, containing, as it does, more than 95 per cent. of water; notwithstanding this it is apt to prove very indigestible, and to give rise to gastric disturbance.

Figs both in the green and dried state contain much sugar, and also a rather large proportion of nitrogenous matters, so that they are more nutritious than most fruits; in large quantities they are apt to prove aperient.

The **date** is also a highly nutritious fruit, and forms an important food for the Arabs.

The **banana and plantain** are also nutritious fruits, as they contain much sugar and a certain proportion of nitrogenous matters.

with a certain amount of wax, gum, and odorous and colouring substances. It contains a crystallisable and a non-crystallisable sugar — the former resembles glucose.

Before the discovery of sugar, honey used to be largely employed as a sweetening agent, and it has the same food properties and value as sugar.

the better; most, however, of so-called drinking waters as derived either directly from springs or from wells and rivers, contain dissolved gases and mineral substances. These often improve the flavour of the water, and give it a pleasant freshness, but an excess of mineral ingredients detracts seriously from its solvent properties.

Rain water is the purest form of *natural* water, and resembles distilled water, except that it contains whatever soluble constituents exist in the atmosphere through which it has fallen, so that traces of ammonia and nitric acid are generally to be found in it. If used for drinking purposes it needs to be collected with great care, as it is apt to dissolve any soluble substances with which it comes in contact. It must therefore not be received in leaden cisterns.

Distilled water is now largely used at sea, as most passenger ships are provided with condensing apparatus. When aërated it is a pleasant, wholesome beverage.

It is not needful, in this place, to insist on the importance, which is now generally recognised, of ascertaining that the water we use for drinking purposes is free from all organic impurity; most spring waters, however, although quite pure in this sense, contain a variable quantity of mineral constituents, especially of salts of lime, and these, if abundant, may detract from the value of the water for drinking and domestic purposes. Such water may cause digestive disturbance, or promote constipation, or may intensify any tendency that exists to calculous disorders. *Boiling* the water has the effect of greatly diminishing the hardness due to the presence of earthy carbonates, and so rendering it more suitable as a beverage.

Water which is not quite pure may be rendered much purer by suitable filtration.

Water, then, is an indispensable beverage; as a

Tea.—A great many varieties of tea are now imported into Britain from India and Ceylon, besides the older kinds grown in China.

The average composition of dry tea is stated by Bauer to be as follows:—

Thein	1·35
Other Nitrogenous Combinations .	9·44
Non-nitrogenous Extractives . .	19·20
Ash	3·65
Total of Matters soluble in Water .	33·64 per cent.

In Parkes's "Manual" the composition of dry tea is thus given:—"About 1·8 per cent. of thein, 2·6 of albumen, 9·7 of dextrin, 22 of cellulose, 15·0 of tannin, 20·0 of extractives, 5·4 of ash, as well as other matters, such as oil, wax, and resin."

The thein is combined with tannic acid. Some of the best teas yield a much larger proportion of thein than others. *Green* tea is somewhat richer than *black* in thein, ethereal oil, and tannic acid, and indeed in all the soluble constituents, by about 5 per cent.

The *ash* contains potash, soda, magnesia, phosphoric acid, chlorine, carbonic acid, iron, and silica. The principal constituents, and those which give it its characteristic properties, are thein, an aromatic volatile oil, and tannic acid; of the last it contains, as stated above, about 15 per cent.

The difference between *green* and *black* tea is simply dependent on differences in the time of gathering the leaves, and their mode of treatment. The *green* is prepared from younger leaves, which are roasted in pans soon after gathering. Of China teas, *Young Hyson* is considered the finest kind of *green*, and *Souchong* and *Pekoe* of *black* tea. Some teas are "scented" in China by mixing the leaves with odorous flowers, such as orange-blossom, jasmine, roses, etc.

With regard to the amount of tannin contained

and nervous disorders in sensitive persons than the best China teas; and that cheap teas are much more likely to prove injurious than costly ones. Sample No. 2 was worth retail about five shillings a pound.

In making an infusion of tea the water should be boiling, for delicacy of flavour it should be neither too hard nor too soft, but for economical purposes the softer the water the better.

Parkes suggests that as water containing much lime or iron will not make good tea, such water should be well boiled for fifteen to twenty minutes with a little carbonate of soda before it is used for making tea, and Sir William Roberts also advocates the addition of carbonate of soda to tea for other reasons, as will be immediately mentioned.

Soft water extracts more of the soluble principles of the leaves, and makes a darker infusion, but some think that the infusion is, on that account, of less delicate flavour. The infusion should not be for more than three or four minutes. Longer infusion lessens the aroma and extracts too much of the soluble matters, thereby diminishing the delicacy of flavour of the beverage.

As to the effects of tea as an article of diet much difference of opinion exists, and especially as to the relative value of tea and coffee. It should be recognised that there often exist great individual peculiarities with regard to the effects of these beverages, and hence the conflict of opinion on this point.

Pavy refers to tea as "not heating to the system, nor oppressive to the stomach" like coffee; there are other physicians who consider coffee much more digestible than tea.

Tea appears to act as a stimulant and restorative to the nervous system. It removes fatigue, rouses and clears the mind, and promotes intellectual energy. It diminishes the tendency to sleep, and this effect

moderation, with impunity. In irritable states of the stomach tea is also apt to disagree, especially if the coarser teas containing much tannin are taken ; these, when taken in large quantity during or too soon after a meal, will disturb, and often seriously hinder, the digestive process.

The ordinary strength of tea, according to Sir W. Roberts,* is 4 to 5 per cent., "that is four or five parts of the dry leaf to a hundred parts of boiling water. Strong tea runs up to about 7 per cent., and weak tea goes down to 2 per cent." This excellent observer found that tea exerted an inhibitory or retarding effect on salivary and peptic digestion, and he concludes that this effect is due to the influence of the tannin it contains. He points out that this cannot be avoided by brief instead of protracted infusion : "Tea infused for two minutes was not found sensibly inferior in its retarding power on salivary digestion to tea infused for thirty minutes." The best way to minimise the inhibitory effect of tea on digestion is to make it very weak and use it very sparingly, and to drink it after and not with a meal. Adding a little carbonate of soda—10 grains to 1 ounce of the dry tea-leaf—had the effect of entirely removing this retarding effect on digestion.

Coffee.—Coffee is an agreeable aromatic beverage prepared from the seeds, after they have been roasted, found within the fruit of the *Coffea arabica.*

The choicest coffee is Mocha or Arabian coffee. It was introduced into Europe in the seventeenth century, about the same time that tea was also introduced. In roasting, the coffee berries are exposed to a temperature of 200° Cent. or more ; during the process they assume a dark brown colour, the sugar in the berry is converted into caramel, and volatile aromatic empyreumatic products are developed which give to coffee its aroma.

* "Lectures on Dietetics and Dyspepsia."

nutritive and tonic properties, while it gets rid of its exciting ones.

The value of coffee, as a beverage, is greatly detracted from in Great Britain by the singular want of care and skill so widely manifested in its preparation.

Coffee should be made perfectly fresh, from freshly ground and freshly roasted seeds: as *all* the soluble substances are not extracted by infusing alone, it is desirable, on economical grounds, that a mixed infusion and decoction should be made in the following manner:—After first preparing an infusion by passing boiling water over the coffee, the grounds left should be boiled in more water, and the boiling decoction thus obtained should be poured over another portion of freshly ground coffee; this, in its turn, is also boiled with more water, to be used again with fresh coffee in the same manner, and so on. By this method all the soluble matters in the coffee are extracted, and none of the aroma is needlessly dissipated.

The effects of coffee on the system are those of a decided stimulant to the nervous centres. It has been termed in France *une boisson intellectuelle*, on account of its stimulating action on the brain. It lessens the need for sleep after exertion, and diminishes the sense of fatigue; indeed, it would appear to have the power of augmenting the functional activity of the muscles. It has also a decidedly stimulating effect on the heart; in small quantities it quickens its action, but in large quantities it slows it, and when taken in *excessive* amount it will often sensibly disturb the rhythm of this organ and cause intermission.* It increases the secretion of the kidneys and of the skin, and in some persons it will stimulate the peristaltic movement of the intestine, and so act as an aperient.

* The author has seen several instances of this toxic effect of coffee when taken inadvertently in excess.

i.e. it diminishes the organic waste, as is evidenced by the diminished excretion of urea by the kidneys, as well as of carbonic acid by the lungs. Coffee does nothing of the kind; it maintains the *statu quo*, or it may accelerate retrograde metamorphosis, in consequence of its active stimulation of the functions causing increased tissue change.

"Alcohol excites in a fugitive fashion the peripheral circulation. Coffee imparts new energy to the heart and blood-vessels.

"Coffee increases the temperature: alcohol diminishes it (in large doses).

"The muscular system and muscular energy are marvellously roused by coffee, and a man fatigued or over-worked can find no more wholesome support: whereas alcohol produces on the muscles a dubious passing excitement, and in the end a degeneration of all the organs of human activity."

He concludes by pointing out that so far as the nervous system is concerned, coffee is an antidote to alcohol. This is probably why it has become the custom to take coffee after dinner and the wine-drinking which usually accompanies that meal.

Sir W. Roberts' experiments showed that coffee exerted very little retarding influence on salivary digestion, as compared with tea, and this he accounted for by the fact that in coffee tannin "is replaced by a modification of that substance called caffeo-tannic acid." Coffee, however, was found to exercise a greater retarding influence on *stomach* digestion than tea, on account of its being taken in much stronger percentage infusion. "Strong coffee, the *café noir* of France, is seen to have a very powerful inhibitory effect;" * hence it should not be taken after a meal by dyspeptic persons.

Cocoa or **cacao.**—Cocoa is widely removed by its composition and character from tea and coffee. It,

* "Dietetics and Dyspepsia."

to a complete food. Its defect is the large amount of fat it contains, which renders it prone to disagree with persons of delicate digestions. It is the avowed object of the best preparations of cocoa to diminish the relative amount of fat by the addition of other suitable substances, or to promote its digestibility by the admixture of some alkali.

Cocoa and chocolate present a convenient and palatable form of a highly nourishing food, and in South America cocoa and maize cakes are carried by travellers because they provide an agreeable kind of food in small bulk.

It will be seen that it is only the decoction of the nibs that can really be likened to tea or coffee as a beverage; the other forms of cocoa containing a large proportion of nutritious solids.

Chocolate is largely used in France to mix with various medicaments, in order to dilute them, or to disguise their taste and make them agreeable to the palate.

The following table, adapted from König, gives the average composition of cacao beans (kernels) and the best kind of chocolate :—

	Cacao Beans.	Chocolate.
Water	3·25	1·53
Nitrogenous Substances . .	14·76	5·06
Fat	49·00	15·25
Starch	13·31	—
Sugar	—	63·81
Other Non-nitrogenous Matters	12·35	11·03
Woody Fibre	3·68	1·15
Ash	3·65	2·15

Maté or Paraguay tea is prepared from the dried leaves of the *Ilex paraguayensis*, belonging to the holly

manner as any other food of similar chemical composition: this is the answer given by many experimenters, and it is the one supported by Dujardin-Beaumetz * as the result of his own recent experiments. "In the blood," he says, "you bring together two bodies, one alcohol, eager for oxygen, the other hæmoglobin, ready to give up that oxygen under the feeblest influence, even that of an inert gas, and you imagine that no exchange takes place between these two bodies; such changes do take place; alcohol, under the influence of hæmoglobin, is transformed into acetic acid. A portion of the alcohol ingested undergoes combustion at the expense of the oxygen of the hæmo-globin of the blood globules. When alcohol is introduced into the economy in non-intoxicating doses, it is in part oxidised, and transformed, first, into acetic acid, then into alkaline acetates, and finally into carbonates. Alcohol, then, is a food, *un aliment d'épargne*, which instead of promoting combustion [of the tissues], on the contrary retards it by withdrawing a certain quantity of oxygen from the blood corpuscles. It is to this action on the blood globules that it owes its power of lowering the temperature of the body, especially notable when toxic doses are administered. In such instances the alcohol is no longer consumed, but it destroys the blood corpuscles and dissolves the oxyhæmoglobin. That portion, however, of the ingested alcohol which does not undergo combustion, acts directly on the cerebro-spinal nervous system, giving rise to the phenomena of intoxication, of sleep, and of vaso-motor changes varying according to the amount of alcohol ingested. These three properties of alcohol, alimentary, anti-thermic, and toxic, render alcoholic beverages most powerful remedies in febrile diseases." This opinion has the merit of clearness and definiteness, and is founded on the results of careful experiment.

* "L'Hygiène Alimentaire. Des Boissons."

quickly give place to a sedative, and in some persons, even in moderate quantities, to a depressing effect. It produces, then, *temporary* stimulating effects on the nervous and circulatory systems; there is, for a time, mental exhilaration and a more rapid flow of ideas, while there is also quickened action of the heart and increased fulness of the pulse. This is followed by a *sedative* effect on the nervous system, often of very great value. It has also the effect of causing dilatation of the peripheral blood-vessels, in consequence of which the face flushes, and there is a subjective feeling of warmth following its use.

In small quantities, by stimulating the secretion of the gastric juice, it promotes appetite, but in large quantities it has the opposite effect, and is, as will presently be seen, a *retarder* of digestion.

In its action on the nervous system small quantities exhilarate, large quantities (after a brief period of excitement) are sedative and narcotic.

It is most important to remember that the effects of alcohol vary greatly in different individuals, and that what may only be sufficient to produce a pleasant exhilaration in one person, will cause toxic depressing effects in another.

Indeed, it is mainly on account of the remarkable difference in its effects on different persons that so much misapprehension exists as to its true character.

Alcohol is a useful food and an agreeable stimulant, or a narcotic poison, according to the dose in which it is taken, or the susceptibilities and tissue reactions of the individuals to whom it may be administered.

Experiments as to the effect of alcohol in health have generally been made with too large doses, so that they have only furnished information, valuable certainly so far as it goes, of the effects of alcohol *in excess.* For instance, to test the effect of alcohol on

Alcohol taken in excess is known to lead to very serious morbid changes in nearly all the organs of the body. Chronic inflammatory and degenerative changes of a granular, fibroid, and fatty nature attack the stomach, liver, lungs, kidneys, the brain and its membranes, and especially the blood-vessels. This, however, is not the place to discuss the many and serious morbid conditions which are produced by the excessive use of alcohol.

With regard to the influence of alcoholic beverages on the digestive processes, Sir William Roberts has made some valuable experiments, and the conclusions he has arrived at with regard to spirits may be thus briefly summarised.

With respect to ardent spirits, such as brandy, Scotch whisky, and gin, he found that these spirits used in moderation, and well diluted, promote rather than retard salivary digestion ; that they increase the salivary secretions.

"The common practice of adding a tablespoonful of brandy to a basin of arrowroot or sago gruel therefore promotes its digestion."

With regard to peptic digestion, it was found that with 10 per cent. and under of proof spirit, there was no appreciable retardation, and only a slight retardation with 20 per cent., but with large percentages it was very different, and with 50 per cent. the digestive ferment was almost paralysed.

In the proportions in which these spirits are usually employed dietetically, not only do they not appreciably retard digestion, but they "act as pure stimulants to gastric digestion, causing an increased flow of gastric juice and stimulating the muscular contractions of the stomach, and so accelerating the speed of the digestive process in the stomach."

It will be necessary, in the next place, to consider

flavour are due to the presence of volatile ethers, which pass over during distillation. Brandy improves in flavour by keeping, while it loses in strength. On an average it contains about 42 per cent. of alcohol. Dietetically it is highly valued, when of good quality, for its delicacy of flavour and its purity as a spirit.

Rum is distilled, in the West Indies especially, from the fermented products of the sugar cane. When new it is of somewhat coarse flavour, which becomes greatly refined by age. It is the spirit usually served out in the British army and navy. It is of about the same strength as brandy.

Whisky is extensively distilled in Scotland and Ireland from malted grain, usually barley. The smoky flavour is due to the *peat* and *turf* fires used in drying the grain. A certain amount of age is necessary to render whisky wholesome. It may be used in the same manner as brandy, and is more likely to be obtained *pure* than that spirit.

Gin and **Hollands** are corn-spirits, distilled from the unmalted grain. It is necessary in this case that the first distillation should be purified by re-distillation. Gin is flavoured subsequently by the addition of juniper and other flavouring agents; it is also sweetened by the addition of sugar, so that gin may be obtained either "dry" or "sweet." Dry Plymouth gin is one of the most wholesome kinds. It is more diuretic than other spirits on account of the juniper it contains.

Arrack is a spirit distilled from a fermented infusion of rice.

Kirsch, or **Kirsch-wasser,** is a spirit largely drunk in Germany and on the Continent. It is distilled from cherries.

Spirits distilled from grain or from the potato are apt to be contaminated with *amylic* and other alcohols

his experiments he noticed that brandy and Scotch whisky interfered with the digestive processes, "precipitated the starch more readily," altogether out of proportion to the amount of alcohol they contained, and brandy was worse than whisky; and this circumstance appears to be due to certain ethers and volatile oils in them; and brandy contains a trace of tannin, which has an intensely retarding influence on salivary digestion.

Little need be said of the various alcoholic *liqueurs* in ordinary use. They owe their sweetness to added sugar, and their characteristic flavours to various aromatic substances. *Curaçoa* is flavoured with orange peel; *Noyeau* with the kernels of the peach and apricot; *Maraschino* with a flavour derived from cherries; *Kümmel* with cumin and carraway seeds; *Anisette* with aniseed and coriander.

Chartreuse and *Benedictine*, etc., are distilled from a mixture of various aromatic substances.

Absinthe is bitter, being flavoured with wormwood. It is usually taken mixed with water, before a meal, to stimulate appetite.

Kümmel is considered by some authors to be the most wholesome of these liqueurs.

Wines.—We have seen that alcohol and the ardent spirits are obtained by distillation from saccharine fluids that have undergone fermentation. The juices of all saccharine fluids can be made to undergo the alcoholic fermentation. This is usually set up by the agency of the yeast fungus, which causes the sugar to break up into ethylic alcohol and carbonic acid.

The most ancient and popular of these fermented drinks are those which have been obtained, since the earliest times, from the juice of the grape; and it is to the fermented juice of the grape that the term "wine" usually applies. This term is, however, also

in composition during the processes of fermentation and preparation. The sugar is, in great part, converted into alcohol, glycerin and succinic acid being at the same time formed. The fermentation, however, in many wines is arrested before the whole of the sugar has been exhausted, and the proportion of sugar thus left in the wine gives it one of its distinctive characters.

The tannin which gives astringency to wine is found only in any considerable amount in *red* wines, and is derived from the stones, the skins, and the stalks. The *aroma* of wines is usually developed during fermentation and after it has been in bottle; but in some instances, as in the Muscat, it depends on the grape itself.

The chief acids of *must* are malic and tartaric. Malic acid is found principally in the unripe grape. They both diminish in amount as the fruit ripens, while the proportion of sugar at the same time increases.

Good wine should not contain more than 0·5 per cent. of tartaric acid. Owing to the variability of climate and seasons in the north of Europe, and the consequent imperfect ripening of the grape in certain years, the Rhenish and Moselle wines are apt at times to contain an excess of acid.

The amount of sugar in wine depends much on climate, the grapes grown in hot climates containing much more saccharine matter than those grown in colder regions. It also depends on the degree of ripeness of the fruit when gathered, and so also upon the season, for in cold, wet seasons the grapes will not ripen thoroughly, and will therefore contain less sugar. The amount of sugar will vary in different wines from 10 to 30 per cent. In order to make good wine the *must* should contain not less than 20 per cent. of sugar. Warm and dry

carries down with it the suspended organic and other impurities. The wine is thus rendered clear, bright, and durable.

Plastering is the term applied to the practice that prevails in Spain, Portugal, and the south of France, of either dusting plaster of Paris (sulphate of lime) over the grapes before they are crushed, or adding it to the *must.* This leads to the deposition of the greater part of the natural tartaric acid in combination with lime, and to the substitution of sulphate of potash in its place, an altogether undesirable change so far as wholesomeness is concerned, but the keeping properties of the wine are probably improved.

In the preparation of sparkling wines like champagne, a second fermentation is set up by the addition of syrup, and some of the carbonic acid is prevented from escaping, so that an effervescing character is given to the wine, while a special flavour is imparted by the addition of "liqueur."

Little that is of practical value can be learnt from the *minute chemical analysis* of a wine; the palate and the stomach are the most reliable tests of its quality and wholesomeness.

Dujardin-Beaumetz well remarks that "it is a profound error to regard wine as merely a mixture of water and alcohol. It is a complete, living whole . . a living being" of very complex constitution. "It has," he goes on to say, "its youth, its maturity, and its old age. Some growths, like those of Burgundy, have a short life and a precocious old age; others, like Bordeaux, have a much longer life, and are even made to travel to hasten their maturity. They have also their diseases, diseases which result most commonly from bad manufacture or faulty fermentation giving rise to the presence of impure products." Besides water and alcohol, wines contain glycerin, sugar, tannin, essential oils, ethers, colouring matters and

It is only in the sweet liqueur-like wines and in those to which *sugar* is added in the manufacture, that this substance exists in any considerable amount. According to Bauer, *Ruster* contains 21·74 per cent. of sugar, *Tokay* 14·99, *Malaga* 16·57, *Champagne* 11·53, *Sparkling Hock* 8·49, *Port* 6·42, *Marsala* 3·48, *Madeira* 3·46, *Sherry* 1·88.

In the Rhenish and Moselle wines there is but a very small quantity of sugar. In *Johannisberg* only 0·42 per cent., in *Rudesheimer* 0·39, in *Zeltinger* 0·13, and in *Stein-Reisling* 0·01.

In Clarets and Burgundies it is either absent, or present in very small quantity.

The amount of *tannin* found in different wines varies greatly. As it is derived chiefly from the coloured skin of the grape, it is absent, or in very small quantity, in white wines. New ports contain it in greatest quantity. On keeping, the tannin becomes deposited in combination with cream of tartar and colouring and extractive matters, and forms what is known as the "crust."

Most wines contain some *free acid*, as well as the acid bitartrate of potash. The free acid is chiefly *tartaric*, with smaller quantities of malic and acetic acids. The white wines contain most free acid, the Rhenish and Moselle wines from 1·14 per cent. (Marschberg) to 0·33 (Rudesheimer), Champagne 0·58, port and sherry about 0·45, clarets about 0·60.

The *bouquet* and aroma of wines depend chiefly on the presence of compound *ethers* and volatile oils. The ethers, the chief of which is termed *œnanthic* ether, are developed in the wine as it ages, and become especially noticeable after it has been long in bottle. They are formed by the reaction of the acids in the wine on the alcohol, and are therefore more remarkable in the more acid wines as in those of the Rhine and Moselle.

moderation and somewhat diluted with water, as is usual in France.

The Burgundies contain more alcohol than the Bordeaux wines, and are considered more "heady," but they are valuable when a somewhat stronger and more tonic wine is needed.

The red Hungarian wines, such as Carlowitz and Ofner, form good substitutes for French wines.

The *white* or *acid* wines contain less tannin and more free acid than the preceding. They are somewhat more diuretic, and are wholesome and refreshing, especially when diluted with some alkaline water, which removes the excess of acidity without injury to the other qualities of the wine. Most of these wines are grown in northern countries, and come from the banks of the Rhine and Moselle. France also has several white wines, such as Barsac, Vin de Grave, and the Sauternes, from the Bordeaux district; and Chablis, from Burgundy. Many of the Sauternes, however, are strong saccharine wines, and cannot be said to resemble greatly the white acid wines of the north. Some also of the white Hungarian wines, as Ruster, are rich in saccharine constituents.

The type of *sparkling* wines is Champagne. This wine, when pure and sound, is most valuable as a rapidly-acting restorative and stimulant, and is often of great service from its power of allaying irritability of the stomach by means of the carbonic acid it contains.

With regard to the influence of wines on the digestive processes, Sir W. Roberts has made some instructive observations. He found that even very small quantities of the stronger and lighter wines—sherry, hock, claret, and port—exercised a powerful retarding influence on salivary digestion. He considers this to be wholly due to the *acid*—not the alcohol—they contain; for if this acid be neutralised, by mixing with the wine some alkaline water, the

most useful which are absorbed and eliminated from the system *with the greatest rapidity*, as tested by the increase of the renal secretion, and he has been led to the practical conclusion that this is the best criterion of the suitability of any particular wine to any particular constitution. If the effect of different wines on notoriously gouty persons be carefully observed, it will be found that some can drink champagne (in moderation, of course) with impunity, especially if a small quantity of an effervescing alkaline water be added to it, while claret will at once provoke some manifestations of gout; others who are unable to drink champagne without provoking a gouty paroxysm, will often be able to drink a mature, fine, soft claret with advantage; others will support hock well, and a few can drink fine sherries and ports in small quantities; but in all it will be found that the test of the suitability of the particular wine to the particular constitution is its susceptibility to rapid elimination, and *vice versâ.*

Cider and perry.—These fermented beverages, obtained respectively from the saccharine juices of the apple and the pear, have much in common with "wines;" and, indeed, in Germany cider is known as "apple-wine." They are usually made in districts where those fruits abound.

Their "alcoholic" strength varies. In England and in Germany it has been estimated at from 5 to 9 per cent.; but some of the sweet ciders of France do not contain even 2 per cent. of alcohol. They contain also acids, chiefly *malic*, extractives, and salts. The alkaline salts, malates, carbonates, and phosphates impart diuretic properties, and those of potash some slight aperient effects.

It has been suggested by Denis-Dumont, of Caen, that the diuretic properties of cider render it a useful beverage for the gouty and those who suffer from uric

attended to in the preparation of the various kinds of beer with which we are not concerned.

The chemical composition of beer is somewhat complex; besides *water* and *alcohol*, it contains sugar, dextrin, albuminates, aromatic, bitter and colouring matter, salts, and a varying amount of acetic and carbonic acid.

The following analysis of German beers is adopted from König :—

	Water.	Carbonic Acid.	Alcohol.	Albumen.	Extractives.	Ash.
Mild (Winter) Beer	91·81	0·23	3·21	0·81	4·99	0·20
,, (Summer) ,,	90·71	0·22	3·68	0·49	5·61	0·22
Strong (double) ,,	88·72	0·25	4·07	0·71	7·23	0·27
Porter . . .	88·52	0·21	5·16	0·73	6·32	0·27

By keeping the amount of alcohol gradually increases and that of extractives diminishes; "old ales" are therefore, as a rule, *strong* ales. The colour of beer depends on the temperature at which the malt is dried, also the longer the wort is boiled the darker it becomes.

The average percentage amount of alcohol, extractives, and ash in various well-known beers is thus given by Dujardin-Beaumetz after Girard and Pabst.*

	Alcohol.	Extractives.	Ash.
English Beer (for exportation) . .	7·3	5·9	0·35
London Porter	5·2	6·4	0·32
Strasburg Beer	4·7	4·65	0·32
Bavarian ,, ...	4·5	7·2	0·29
Saxony ,, ...	3·7	5·8	0·25
Bohemian ,, ...	3·6	4·7	0·20
Vienna ,, ...	3·5	6·1	0·20

* "L'Hygiène Alimentaire. Des Boissons."

digestion of alimentary carbo-hydrates through the influence of a certain amount of diastase in it. Light beers in which the bitter principles predominate and the extractives are small in amount, no doubt act as stomachics and tonics.

It has been remarked that great beer-drinkers are subject to heaviness and drowsiness, and these effects are referred to the narcotic principles in the hops (*lupulin*); but Ranke has suggested that it is caused in part by the potash salts in it. It is believed that the habitual excessive consumption of beer may interfere with due oxidation and elimination to such an extent as to lead to the accumulation in the system of imperfectly oxidised products such as oxalic and uric acids, and so engender biliousness and goutiness. To avoid such possible evils the quantity consumed daily should not exceed a pint of the stronger beers or two pints of the weaker ones. Porter appears to be easier of digestion than beer.

Sir William Roberts' observations on the effects of beer on salivary and peptic digestion showed that "malt liquors hamper salivary digestion exactly in proportion to their degree of acidity. Sound English beers have not nearly so much acidity as wines, and they interfere comparatively little with the digestion of starch; but 'turned' beer is highly inhibitory." With respect to peptic digestion malt liquors exerted a retarding effect "altogether out of proportion to their percentage of alcohol." In large quantities they are powerful retarders of stomach digestion, in particular of farinaceous foods. "But in more moderate quantities—a tumbler or so—especially of the lighter beers," they assist digestion, and this is particularly the case when the beer is "well up," *i.e.* when it contains a considerable amount of free carbonic acid.

alkalinity of the blood and the number of the blood-corpuscles." *

Many substances used as condiments contain small quantities of ethereal oils and other aromatic substances—as mustard, pepper, horse-radish, ginger, nutmeg, cinnamon, cloves, allspice, saffron, vanilla, mint, thyme, fennel, sage, parsley, garlic, etc., etc.

Many of these, by conferring agreeable flavours and by their warm carminative properties, promote appetite and assist digestion; but their excessive use is calculated to excite irritation and disorder of the digestive organs.

* "Dietary of the Sick."

quantity, it causes starch to take up the elements of water and become soluble, undergoing itself no essential change in the process. Saliva acts but slowly on raw, unboiled starch, because the starch-grains consist of *granulose*, or starch enclosed in coats of cellulose, and cellulose appears to be unaffected by saliva. When the starch is boiled, the starch-grains swell up, the cellulose envelopes are ruptured, and thus the diastasic action of the *ptyalin* can take effect. Hence the necessity of thoroughly boiling all starchy food or raising it to a high temperature.

During the early months of infant life the salivary glands are very imperfectly developed, and it is not, therefore, advisable to give starchy food to young infants. Saliva acts best in an exactly neutral medium; but it also acts in an alkaline and even in a slightly acid fluid. Its action is, however, arrested or prevented by a strong acid; so that when the contents of the stomach are decidedly acid, and especially when it contains free hydrochloric acid, the action of the saliva on starch is arrested when the food reaches that organ. If the acidity be neutralised, the action is resumed.

Bauer suggests that the chemical action of saliva in digestion is infinitely less than might at first sight be supposed, as the food remains so short a time in the mouth, and the transformation of starch into sugar is arrested by the acid gastric juice, and that its chief use is to soften, moisten, and aid in the mechanical subdivision of the food-mass, and also, by covering it with mucus, to enable it to be easily swallowed. Substances soluble in water are dissolved by the saliva, and sapid matters are thus brought into contact with the end-organs of the nerves of taste.

Sir William Roberts observes with regard to salivary digestion that, as the time for it is brief, "to

of brandy to a basin of arrowroot or sago-gruel, therefore, promotes its digestion." But the proportion must not exceed 5 per cent., and gin seems to be preferable to either brandy or whisky. In whisky and brandy there are certain ethers and volatile oils, and in the latter a trace of tannin, and these appear to exert an intensely retarding influence on salivary digestion. And the *stronger* mixtures of all these decidedly retard salivary digestion. With regard to wines, it was found that even small quantities of such wines as sherry, hock, claret, and port exercised a powerful retarding influence on salivary digestion, due, *not* to the alcohol, but to the *acid* they contain; for when this was neutralised by the addition of some alkaline effervescing water, the disturbing effect on salivary digestion was completely removed. The influence of acids in arresting or retarding salivary digestion is important in connection with the dietetic use of vinegar, pickles, salads, etc. In the case of vinegar, it was found that 1 part in 5,000 sensibly retarded this process; so that when acid salads are taken together with bread, the effect of the acid is to prevent any salivary digestion of the bread. As to malt liquors, if they are free from acidity they interfere but little with salivary digestion; but it is otherwise if they are acid. Pure water charged with carbonic acid exercised a considerable retarding influence on salivary digestion; but if it contains an alkaline carbonate, the presence of the alkali removes this retarding effect. Tea was also found to exert a powerful retarding influence on salivary digestion, due to the tannin it contains; coffee and cocoa a comparatively feeble one.

The food when it reaches the stomach encounters the acid gastric juice, and by the agency of this digestive fluid the insoluble albuminates become converted into

Finally, by the continued action of the gastric juice, the pro-peptone passes into true *soluble peptone.* Its formation is due to the taking up of a molecule of water, under the influence of the hydrolytic ferment pepsin. The greater the amount of pepsin, within certain limits, the more rapidly does the solution take place. The pepsin suffers scarcely any change; it would seem, however, that some of it is used up in the process of digestion, but the chief loss is due to its passing, from time to time, with the chyme into the small intestine. The solution of albuminates can only be accelerated within narrow limits by increasing the proportion of pepsin in the digestive fluids, large additions having, apparently, no power of increasing the digestive activity.* Albuminous substances entering the stomach in solution are not first coagulated, as used to be taught, before they are converted into syntonin, except in the instance of casein, which is first coagulated and afterwards dissolved. It has been suggested that coagulated albumen may be regarded as the anhydride of the fluid form and the latter as the anhydride of peptone; this view, therefore, represents the peptones as the highest degree of hydration of the albuminates.

The true peptones have remarkable characters and properties by which they differ greatly from ordinary soluble albumen. They are not coagulated by heat, or by nitric acid, or by acetic acid, and potassium

* Sir William Roberts' observations on peptic digestion, *out of the body*, differ somewhat from this statement which is made on the authority both of Bauer and Landois. He says: "The speed of digestion is roughly proportionate to the amount of pepsin in the digesting mixture. The more pepsin, the greater is the speed of digestion—*without any limit on either side.* And we should probably see . . . if it were possible to arrange the experiment so as to eliminate all interfering conditions, the speed of peptic digestion would be found to be exactly proportional to the quantity of pepsin contained in the digesting mixture." ("Dietetics and Dyspepsia.")

way the food is thoroughly mixed up with the gastric juice, the chyme being prevented from escaping into the duodenum by the contraction of the pylorus; this after three or four hours relaxes, and the acid chyme passes out of the stomach into the small intestine. Do fats undergo any change in the stomach? They are said to undergo partial decomposition with the formation of a small quantity of fatty acids which are of use in emulsifying the rest of the fat; but their real digestion takes place lower down in the alimentary canal.

Peptones can be produced outside the body by dissolving albuminous substances in artificial gastric juice. Such products often possess a disagreeable bitter taste, the cause of which is not thoroughly understood. It has been suggested that it is due to the formation of an alkaloid—of the nature of a *ptomaine*—developed during the decomposition of albuminous matter. These artificially-produced peptones have been regarded as calculated to render great service in invalid feeding. Whether they can fulfil all the functions in the body of albuminous substances, and contribute, like them, to the repair of the nitrogenous tissues, has been warmly discussed. It is admitted that there is no necessity that dissolved albuminous substances should be transformed into peptones in order to be absorbed; they can certainly be absorbed without undergoing such transformation.

It is also known that an increased secretion of urea appears after the administration of peptones, just as it does after the ingestion of unaltered albumen, and that the chemical composition of peptones differs little from that of ordinary albuminous bodies.

But Brucke has maintained, in opposition to those who assert that peptones perform all the functions of proteids, that the absorption of some unchanged albumen is necessary, and that only this is capable of

if any, peptones can be found in it before it reaches the liver. Although it has not yet been discovered where the peptones undergo this remarkable change which renders them fit for appropriation as nutriment, it has been suggested that the liver may, to some extent, serve the purpose of preventing any peptones from reaching the general circulation which may have escaped transformation in the blood of the portal system.

Dujardin-Beaumetz calls attention to the difference observable in the various *peptones* that are found in commerce; "some are acid, some neutral; some are liquid, some solid; and their chemical reactions even are different." He regards the question of peptones as a "very complex" one. The dry peptones he considers preferable to the liquid ones. He calls attention to their disagreeable taste being objectionable to many invalids, and he suspects the more agreeable-tasting preparations of being largely adulterated with gelatin. Instead of promoting the secretion of gastric juice, he has found that they retard it. Their chief value is, he maintains, in rectal alimentation, and the following formula is the one he particularly recommends:—To a cup of milk add two or three table-spoonfuls of *liquid*, or two or three teaspoonfuls of dry peptone, the yolk of an egg, five drops of laudanum and seven grains of bicarbonate of soda if the peptone is acid, as the contents of the large intestine are alkaline or neutral, and never acid. Germain Sée also admits that peptonised enemata may prove valuable as a *temporary* expedient, but that it is impossible to rely upon them exclusively for more than two or three weeks, on account of the inevitable onset of diarrhœa.

Attempts have been made from time to time to estimate the relative digestibility of different kinds of foods in the stomach; but this is a question

body the change is effected almost at once. Even cellulose is said to be dissolved by it, and gum changed into sugar. This ferment is absent, according to Korowin, from the pancreas of new-born children. (2) *Trypsin*,* which digests albuminates, changing them, first, into a globulin-like substance, then into pro-peptone or albumose, and finally into true peptone like the pepsin-peptones, and sometimes termed *tryptone*. Trypsin is destroyed when it encounters pepsin and hydrochloric acid together; so that it is useless administering trypsin by the mouth, as it would be destroyed in the stomach. (3) A *fat-splitting ferment*, *steapsin*. This causes neutral fats to appropriate a molecule of water and split into glycerin, and their corresponding fatty acids, as, *e.g.*:

$$\overbrace{(C_{57}H_{110}O_6)}^{\text{Tristearin.}} + \overbrace{3(H_2O)}^{\text{Water.}} = \overbrace{(C_3H_8O_3)}^{\text{Glycerine.}} + \overbrace{3(C_{18}H_{36}O_2)}^{\text{Stearic Acid.}}.$$

And (4) a *milk-curdling ferment*.

The pancreatic juice has the power of forming a *fine permanent emulsion* with fats. In this process the fats are subdivided into exceedingly minute particles, in which form they can be taken up by the lacteals. The fatty acid, set free by the fat-splitting ferment, enables the alkaline pancreatic juice to at once produce an emulsion, for the presence of a free fatty acid causes emulsification to take place very rapidly.

Putrefactive bacteria appear to find in the products of pancreatic digestion an extremely favourable soil for their development, and under certain circumstances, when pancreatic digestion is prolonged, will give rise to the production of most foul-smelling

* It is a remarkable circumstance that the juice of the green fruit of the papaya tree, or *Carica papaya*, possesses digestive properties, due to the presence of a peptonising ferment closely related to *trypsin*, and termed *caricin* or *papain*.

vegetable foods far less completely than animal foods. The seeds of certain cereals when submitted to a special mode of preparation and cooking form the only exception to this rule.

This difference in the power of utilising animal and vegetable foods is well illustrated in the following table of Fr. Hofmann quoted by Bauer. It gives the percentage proportions *digested* and *undigested* of several animal and vegetable alimentary substances:—

Weight of Food.	Vegetable.		Animal.	
	Digested.	Undigested.	Digested.	Undigested.
Of 100 parts of Solids .	75·5	24·5	86·9	13·1
" " " " Albumen	46·6	53·4	81·2	18·8
" " " " Carbo-hydrates . . .	90·3	9·7	96·9	3·1

The reason of the great amount of waste which passes out of the body undigested in the case of many vegetable foods must not be looked for in any great loss of unassimilated starch; for large quantities of starch are wholly digested and absorbed in the human alimentary canal, if they are contained in foods, which in other respects favour the action of the digestive juices upon them. It has been found, for instance, that the carbo-hydrates in wheaten bread, in macaroni, in rice, etc., are utilised to within 0·8 to 1·6 per cent.; whereas as much as 8 to 18 per cent. of undigested residue passes out of the body from such foods as black bread, potatoes, and the like. Some of these latter set up acid fermentations in the alimentary canal, which excite active peristalsis in its walls and rapid expulsion of its contents. In many of the imperfectly digested vegetable foods the nutritive matters are enclosed in cell-walls of indigestible,

Broken-down muscular fibres could be detected in the evacuations, which is not the case when smaller quantities of meat are taken and digestion is normal; so that, under the latter conditions, certainly a large percentage would be utilised.

With hard-boiled eggs the following results were obtained: in two days, 1,896 grammes of fresh eggs were eaten, representing 495 grammes of water-free (dry) food substance, and containing 41·5 grammes of nitrogen, 206·7 grammes of fat, and 20·9 grammes of ash. The percentage loss of each of these in the fæces was, of

Dry Food Substances . . .	5·2 per cent.
Nitrogen	2.9 „ „
Fat	5·0 „ „
Ash	18·4 „ „

showing that a very large percentage was utilised in the system.

The same observer's experiments with milk showed a very extensive utilisation of the organic constituents, although not so extensive as with the preceding substances, and there was especially a greater loss of salts, and particularly of lime salts.

One experiment lasted three days and three experiments one day each, during which an exclusively milk diet was taken. The following were the results obtained:—

TOTAL WEIGHT INGESTED.

	Fresh Milk.	Dry Substance	Nitrogen.	Fat.	Sugar.	Ash.
1st Experiment (3 days)	7315	945	46·1	285·3	307·2	53·4
2nd „ (1 day)	2050	265	12·9	79·9	86·1	15·0
3rd „ „ „	3075	397	19·4	119·9	129·1	22·4
4th „ „ „	4100	530	25·8	160·0	172·2	29·9

INGESTED.

	Dry Substance	Nitrogen.	Carbo-hydrates.	Ash.
White Bread (3 days)	1364	22·8	1173	29·9
" " " " .	2338	39·1	2010	51·2
Black Bread (2 days)	1529	26·61	1319	39·5
Percentage loss in Fæces.				
White Bread (3 days)	5·2	25·7	1·4	25·4
" " " " .	3·7	18·7	0·8	17·3
Black Bread (2 days)	15·0	32·0	10·9	36·0

Experiments with macaroni gave similar results to those with white bread. The percentage loss in the fæces in two series of experiments with macaroni was as follows:—

	I.	II.
Dry Substances	4·3 per cent.	5·7 per cent.
Nitrogen	17·1 " "	11·2 " "
Carbo-hydrates	1·2 " "	2·3 " "
Fat	5·7 " "	7·0 " "
Ash	24·1 " "	22·2 " "

Rice and maize were also found to be well assimilated by the human digestive organs, and the following table refers to two series of experiments by Rubner with *risotto* and *polenta*, together with Parmesan cheese:—

These figures show that there is a far greater relative loss when large quantities are taken in the food than when small ones are used.

Experiments with regard to the utilisation of potatoes, carrots, and savoy cabbages, showed that it was defective.

INGESTED.

	Dry Substance	Nitrogen.	Fat.	Carbo-hydrates.	Ash.
Potatoes . .	2993	34·37	430·3	2154·5	192·1
Carrots . .	823	12·94	94·6	562·9	82·5
Savoy Cabbages.	1480	39·5	263·5		219·8
		Percentage loss in Fæces.			
Potatoes . .	9·4	32·2	3·7	7·6	15·8
Carrots . .	20·7	39·0	6·4	18·2	33·8
Savoy Cabbages	14·9	18·5	6·1	15·4	19·3

Experiments as to the capacity of the human organs to digest cellulose were tested with celery, cabbage and carrots, and it was found that of *unlignified* cellulose from 47·3 to 62·7 per cent. could be digested.

The *absorption of fat* in the human organism was also tested by Rubner in a series of experiments, in which, besides bread and meat, large quantities of fat, bacon, and butter were administered. The following tables give the results obtained when variable quantities, from 100 grains up to the largest amount possible were consumed, together with bread and meat :—

CHAPTER VII.

THE COOKING, PREPARATION, AND PRESERVATION OF FOOD.

MAN is the only animal that *cooks* his food, and although it is possible there may exist certain savage races that have no knowledge of cooking, it is certain that civilised man invariably cooks some portions of his food, and it would seem also to be certain that advances in civilisation are accompanied by proportionate progress in the culinary art.

Cooking answers most important purposes in connection with food. In the first place it improves or develops agreeable flavours in food, especially in animal foods, and thus renders them attractive and pleasant to the palate. By the action of a high temperature on meat, and the flesh of animals generally, agreeable gustatory properties are developed which they do not possess in the uncooked state, and they are thus rendered capable of giving pleasurable excitement to the sense of taste. Cooking thus increases the desire to take food. In the next place, it enables the food to be more readily masticated, and more easily digested. The mastication of animal food is greatly facilitated by cooking, for in the raw state it is tough and tenacious, and torn apart with difficulty; whereas after cooking the muscular fibres become more solid and firmer, while they lose much of their toughness, and are far more readily divided or torn apart by the teeth, while the fibrous tissue connecting them together is softened and gelatinised. The whole mass is thus rendered much less coherent and more susceptible of mechanical subdivision. The lessened cohesion and increased mechanical divisibility which cooking imparts to food, greatly favour its digestibility, by

and it is then kept on the boil for about five minutes. By this means the albuminous matter in the external layers of the joint is rapidly coagulated, so as to form a protective layer on its surface; this retains the juices and soluble constituents in the interior of the meat, and prevents their escape into the water. The meat is thus kept juicy and palatable throughout its interior, and the broth is thin and poor. After boiling briskly for five minutes, the cooking should be completed at a temperature of 160° to 170° F. If a lower temperature than this be employed, the albuminous matter in the interior will not be properly coagulated, and the joint will cut with a raw and uncooked appearance; and if this temperature be much exceeded, the muscular fibre tends to shrink and become hard and indigestible. Most cooks employ too great heat in boiling, and so cause the meat to be hard and shrunken. Liebig recommended a temperature of 158° to 160° F., and Parkes says after the first five minutes of boiling "the heat can scarcely be too low," and he points out that the "temperature of coagulation of the albuminous substances differs in the different constituents; one kind of albumen coagulates at as low a heat as 86° F., if the muscle serum be very acid; another albumen coagulates at 113° F.; a large quantity of albumen coagulates at 167°. The hæmato-globulin coagulates at 158° to 162°, below which temperature the meat will be underdone. In boiling, ammonium sulphide is evolved with odoriferous compounds, and an acid like acetic acid."

If, on the other hand, the object is to make a rich and nutritious broth, and therefore to extract as much as possible of the soluble constituents of the meat into the water, a different method is followed. The meat, cut into small pieces, is put into *cold* water, and the temperature should then be gradually raised to about 150° or 160°. Actual boiling should be avoided in

The meat should be cooked slowly; and the water should not be allowed to boil, for if boiling occur, the meat will become tough and hard. Much of the nutritive matters of the meat pass out into the surrounding liquid, which becomes thick, rich, and greasy, to which sliced vegetables and other flavouring ingredients are usually added. When properly stewed, the texture of the meat becomes greatly loosened, so that it breaks down readily under pressure, and should be thus rendered easy of digestion; but the other substances and the sauces so frequently added to stews often interfere greatly with their digestibility; and it is probable that when, as is not uncommon, the stewed substances are kept for a very long time at a high temperature, toxic products may be developed by decomposition of some of the albuminates. Stewing is an economical method of cooking meat, as the loss is much less than in boiling or roasting, viz. about 20 per cent., and is chiefly due to the water evaporated. The whole of the stew is eaten—meat, vegetables, and gravy—so that there is no loss of nutritive constituents. When this process is applied to previously-cooked meat it is termed a "hash." In this the meat is often hard, dry, and tasteless.

Braising.—Sir Henry Thompson has called attention to the neglect in England of the method of "braising" in cooking. He refers to it as a valuable process in the preparation of animal food, and as "superior in some respects to that which the term 'stewing' denotes. In braising, the meat is just covered with a strong liquor of vegetable and animal juices (technically called *braise* or *mirepoix*) in a closely covered vessel, from which as little evaporation as possible is permitted, and is exposed for a considerable time to a surrounding heat just short of boiling. By this treatment tough, fibrous flesh, even

of white paper, which serves to shield a delicate morsel from a too fierce heat. The other and inferior way is to very lightly roast the meat before putting it into the pot to braise, and so dispense with the coals on the cover; but this hardens it and prevents the juices penetrating." *

Broiling or grilling is the same as roasting, only it is applied to smaller portions of meat, and is therefore a much more rapid process, and a far larger surface is exposed to the direct action of a high temperature. In order to preserve the juices within the meat the same principle must be applied as in roasting. It is a method which develops the flavour of the meat very completely, and has the further advantage of being rapid and convenient.

The flavour of *baked* meat is inferior to that of meat roasted before an open fire, for when cooked at a high temperature in a confined space the volatile fatty acids generated in the process are unable to escape, and they are therefore retained in contact with the joint, which acquires a rich, strong flavour, and is unsuited for the consumption of persons of delicate digestions.

Frying is also a mode of cooking meat ill suited for the purpose of increasing its digestibility. Usually the meat, cut into thin slices, is put into boiling oil or fat with which it becomes more or less saturated, and is thus rendered somewhat impermeable to the digestive juices. Fatty acids developed during the action of a high temperature on the fat are also apt to remain in contact with the meat, and to lead to disturbance of the digestive process, attended with the formation of irritating acid substances in the stomach.†

* "Food and Feeding."

† Some critical remarks on the process of frying, by Sir Henry Thompson, may be studied with advantage.

"The art of frying," he says, "is little understood, and the

flavour than when boiled in soft water, because of the solvent effect of the latter.

Fish fried in fat is not a suitable food for persons of delicate digestion.

The preparation and nutritive value of soups, broths, and the various meat extracts, will be more conveniently considered hereafter.

The *Cooking of Vegetable Foods* must next be considered. Many vegetable substances used for food by man are absolutely inedible in the raw, unprepared condition, while others are rendered more palatable and digestible by cooking processes. Mechanical subdivision and the action of a high temperature are the chief processes applied to the preparation of vegetable foods. By these processes the vegetable structures are softened and the intercellular substance loosened, so that they are more readily amenable to the processes of mastication; by rupture of the cell walls, the nutritive cell contents are set free, while by the action of heat on the starch granules, the principal alimentary constituent in vegetable tissues, important physical changes occur which greatly aid the digestion of starch. Heat causes the starch granule to swell up, its outer envelope is ruptured, and its contents are set free, so that they can be readily acted on by the digestive secretions. Unless submitted to this influence, the outer envelope of the starch granule offers great resistance to the action of the digestive juices on its contents. Besides this action on the starch granules, cooking, as in the case of animal food, coagulates any soluble albuminous substances in the vegetable tissues or juices; and in boiling, the soluble, gummy, saccharine, colouring and saline matters are, of course, to a great extent extracted in the water.

Undoubtedly, *Bread-making* is one of the most important cooking processes that are applied to the

the sponge is in active fermentation it is thoroughly kneaded with the remainder of the flour, salt and water, and again set aside for a few hours in a warm situation. Fermentation extends throughout the whole, and, at the proper moment, the dough is made into loaves and introduced into the oven. Herein constitutes one of the chief points in the baker's art. Unless fermentation has been allowed to proceed far enough, a heavy loaf is the result; and if allowed to proceed too far, an objectionable quality is given to the bread by the commencement of another—an *acid* fermentation. This is said to be more likely to occur, with the formation of acetic, butyric and lactic acids, when "leaven" has been used as the ferment, and that bread so made has, as a rule, a more or less sour taste. "Time also must not be allowed for the dough to sink before being made into loaves and baked. Under the influence of the heat of the oven an expansion of the entangled vesicles of gas ensues, and occasions a considerable further rising of dough; and with the subsequent setting of the substance of the loaf a permanently vesiculated mass is formed." (*Pavy.*) The alcohol is driven off by the heat of the oven in baking. The best-flavoured bread is said to be that made with brewer's yeast.

The necessary porosity may also be given to the dough by the use of *baking powder* for the evolution of carbonic acid gas. Borwick's baking powder consists of a mixture of carbonate of soda and tartaric acid; and Liebig's, which is by some considered more wholesome, of a mixture of the acid phosphate of calcium with carbonate of soda and chloride of potassium; or carbonate of ammonia may be mixed with the dough, and hydrochloric acid added. The bread thus made has a less agreeable taste than that made by fermentation, and it is a process rarely employed by bakers.

Dauglish's process, which is now largely carried

The effect of the heat applied in baking, on the constituents of the flour, is to increase their digestibility, the nitrogenous constituents are changed, the starch granules are ruptured, and a portion of the starch is converted into dextrin and grape sugar.

Bread varies much both in its digestibility and nutritive properties, just as it differs also in its physical appearance and chemical composition. These differences depend partly on the mode of preparation and partly on the kind of meal employed.

Badly-made bread is often the cause of dyspepsia; the fermentative changes continue in the stomach with generation of carbonic acid gas, and consequent flatulence, heartburn, and acid eructations. This has been attributed to the use of unwholesome yeast; and it has been urged in favour of aërated bread made by the Dauglish method that it is free from such risks; but bread may certainly be badly made, and on that account indigestible, without the fault being necessarily in the yeast. It is undoubtedly a great drawback to the use of the coarser meals and of whole meal for making bread that such bread is often indigestible and heavy, and productive of dyspepsia in some persons of feeble digestion. This is probably, in great measure, due to the diminished porosity of such bread, for it seems to resist aëration and vesiculation to the same degree as is common in the best qualities of white bread. Bauer observes of bread made of coarse, adhesive meal:—"Such adhesive breads are very imperfectly utilised by the human organs of digestion, since the irritation they cause to the mucous membrane of the alimentary canal leads to a rapid progress and early evacuation of its contents"—a property, however, often "usefully employed to overcome habitual sluggishness of the bowels."

Dujardin - Beaumetz also protests against the

Make into flat cakes like 'tea-cakes,' and bake without delay in a quick oven, leaving them afterwards to finish thoroughly at a lower temperature. The butter and milk supply fatty matter, in which the wheat is somewhat deficient. A palatable addition is made, in my opinion, by exchanging the half-a-pound of flour ordered in the foregoing recipe for the same quantity of medium-fine Scotch oatmeal. The change adds to the brittleness and lightness of the product."

The *baking powder* is made by mixing well together—Tartaric acid, 2 oz.; bicarbonate of soda, 3 oz.; common arrowroot, 3 oz. Keep perfectly dry in a wide-mouthed bottle.

The advantages of bread as an article of diet are familiar to every one. It contains a large amount of albuminates and carbo-hydrates; the nitrogen is in the proportion of 1 to 21 of the carbon, so that the addition of some nitrogen would be necessary to make it a perfect food. It is deficient in fat and, if the outer coverings of the grain are entirely removed, in mineral substances. But man never tires of its use, probably because of the great variety of its constituents.

A further cooking of bread in the form of *toasting* is often resorted to, and it appears to increase its digestibility; there is a further loss of water, and the surfaces are scorched, and the bread is made firmer and crisper. It should be toasted in slices *thin enough* to be made crisp all through; when they are thick the central part becomes soft like *new* bread. New bread is well known to be less digestible than stale; the former being soft and moist is more difficult of mastication and insalivation, as it tends to clog together in heavy adhesive masses which are not porous enough to allow of the free access of the digestive juices. Bread, when stale, has the peculiar property of becoming soft and like new bread on re-baking or exposing for

a short time to a high temperature; this has been accounted for on the hypothesis that when bread gets dry by keeping, the water enters into chemical combination with the solid constituents, for if it were due to evaporation of the contained water, it would be impossible to make it appear fresh and new by reheating.

Wheat flour, and the meal of other cereals, is also cooked in various other ways besides being made into bread. *Biscuit*, as the name signifies, is made of dough which is baked much longer, and is harder and drier than ordinary bread, so that it can be preserved for a much longer time. In the French army, besides the *pain de munition*, or ordinary bread, which is reckoned to keep from five to eight days, according to the season, they have when on active service *pain biscuité*, which will keep forty to fifty days. They have also *pain demi biscuité*, which can be preserved twenty to thirty days.

The simplest kind of biscuit is made of flour and water only, or a very little butter is added to prevent it from becoming too dry and hard. Such is the ordinary "ship" or sailor's biscuit. The advantages of biscuit of this kind are that it contains but little water, and is therefore, bulk for bulk, more nutritious than bread, three-quarters of a pound of biscuit being equivalent to one pound of bread; it occupies less space, and is more transportable. Its disadvantages are, that it tends, by keeping, to get very hard and dry, and to become, after long restriction to its use, unpalatable and indigestible, and it is found better for the health of troops to issue a bread ration whenever possible, and to use biscuit only when bread cannot be procured. Parkes calls attention to the value of "unfermented cakes" made simply with water and salt, as a substitute for biscuit in war time. They are palatable, nutritious, and readily made; and

he thinks every soldier should be taught to make them. "The Australian damper is simply made by digging a hole in the ground, filling it with a wood fire, and when the fire has thoroughly burnt up, removing it, placing the dough on a large stone, covering it with a tin plate, and heaping the hot ashes round and over it. In a campaign every soldier, if he could get flour and wood, would soon learn to bake a cake for himself. The only point of manipulation which requires practice is not to have the heat too great; if it be above 212°, too much of the starch is changed into dextrine, and the cake is tough. Exposed to greater heat and well dried, the unfermented cakes become biscuit."

Various other kinds of biscuit are prepared in which sugar, eggs, milk, etc., enter as constituents, and sometimes baking powder or carbonate of ammonia (on account of its volatility) is added to the dough to give them porosity and lightness.

Puddings, pastry, sweet cakes, etc., are made of flour mixed with butter, eggs, sugar, and other substances. These are cooked at a high temperature, being usually baked or boiled, and the flour undergoes similar changes to those which occur in making bread. They are, however, generally rich, and apt to cause stomach disturbances, especially in the dyspeptic. Pastry is especially unwholesome on account of the changes which the heat of the oven causes in the fats mixed with it; and boiled pudding or paste is indigestible because it usually forms a solid tenacious mass, not porous like bread, and penetrated with difficulty by the digestive fluids.

Macaroni, Vermicelli, Pâte d'Italie, etc., are all preparations of flour usually made from hard Italian wheat, rich in gluten. A stiff paste is made with flour and hot water, and this is pressed through holes in metal plates, or stamped into various forms,

Many kinds of farinaceous foods are prepared by boiling with milk, eggs, etc., and served in semi-fluid form easy of digestion, and very suitable for invalids, young children, and persons of delicate digestion. Oatmeal gruel, rice-milk, and milk puddings made with sago, arrowroot, tapioca, macaroni, etc., afford very useful foods, especially appropriate to states of convalescence, and as a transition from fluid to solid foods.

Rice requires to be cooked carefully, or the grains remain hard and indigestible; thorough steaming, so that the starch granules shall be completely swollen, is the best process to adopt.

Peas and *beans* also require thorough boiling, slowly, and for a long time, in order to be made digestible. If old, no amount of boiling will soften them, they must then be soaked in cold water for twenty-four hours, crushed and stewed.

The *potato*, a vegetable rich in starch, also requires careful cooking. Steaming is the best method, as there is then no loss of salts, but the heat should be moderate. If boiled, it should be in their skins to prevent the loss of salts, and the boiling must be thorough or the starch granules will remain indigestible; and also *slow*, otherwise the cellulose and albuminates will be hard.

"*Mashed* potatoes" is a useful method of serving this vegetable, as it effectually gets rid of the hard indigestible masses into which a badly cooked or imperfectly masticated potato is apt to reach the stomach.

Most *fresh green* vegetables and edible *roots* are boiled in water according to definite culinary rules, and their digestibility and wholesomeness depend greatly on their being well and carefully cooked. They should be selected young and tender, and boiled sufficiently to acquire the necessary softness.

considerable time by special methods of preservation. These methods are mainly four in number :—

1. The method of *drying* food, or getting rid of the greater part of the water contained in it.
2. The exclusion of atmospheric air; or, what amounts to the same thing, covering the food with an impermeable coating.
3. Exposure to cold.
4. Treatment with antiseptic chemical agents.

Some of these methods are frequently combined. Drying by exposure to the air is a very ancient and primitive method of preserving animal food, and is practised largely in savage or half-civilised communities. In countries where the air is dry and pure, and the solar radiation intense, it is a ready and convenient method; the meat is simply cut into slices and exposed to the air. The Kaffirs thus preserve large masses of beef that have been sun-dried. The Egyptians also preserve meat by exposing it to the sun and north wind.

Charqui is the name given in South America to strips and slices of beef, freed from fat and dried rapidly by sun heat, and sprinkled with maize. *Tasajos* is also a preserved meat prepared in South America, by cutting it in thin slices, then dipping it in brine and partially drying. *Pemmican*, a food used by Arctic travellers, consists of a mixture of the best beef and fat dried together, and is very nutritious, but costly. Sugar is sometimes added to it, as well as raisins and currants, which increases its value when fresh vegetables are not procurable.

Meat may also be dried at a very low heat; it gets very hard from having lost the greater part of its water, and requires careful cooking.

There is a preparation of dried meat by M'Call, of London, which retains 12 per cent. of water, and is

Other *vegetables* can be dried and compressed, such as peas, cauliflower, carrots, etc., and so successfully that those of Masson and Challot, if properly cooked, are almost equal to fresh vegetables. They must be cooked very slowly. Professor Attfield's analysis showed that dried compressed cabbage contained the solids of seven times its weight of fresh cabbage, and the mixed vegetables five and a half times the solids of the fresh vegetables. The experience of the American war showed that as anti-scorbutics they were much better than nothing, but inferior, however, to fresh vegetables. Vegetables preserved in bulk, without drying, are much better as food, and as antiscorbutics.

Milk can also be preserved by *drying*, and is sold as a powder.

Eggs can be dried, but the yolk does not keep well. Mixed with flour, ground rice, etc., both yolk and white can be dried and preserved.

The *drying of fruits* is a very well-known means of preserving them.

A combination of drying, salting, and smoking is a very common domestic method of preserving several kinds of animal food.

2. The *exclusion of air* is another largely employed method of preserving food. The immersion of fish (previously somewhat salted) in oil, the covering potted meats with a layer of melted fat, are familiar illustrations of this process. By simply exposing the surface of meat to a strong heat, so as to coagulate the outside albuminous layers, it can be, on this principle, kept for some time.

Any means by which foods can be covered with an impermeable coating, and so protected from the action of the air, will usually preserve them for a long time; in this way by coating eggs with a solution of bees' wax in warm olive oil (one-third of bees' wax to two-thirds of olive oil) they may be preserved for two

3. Another method is the application of *cold.* It is a well-known domestic expedient to keep perishable food substances on ice, and fish is invariably packed in ice to convey it to market, and to preserve it fresh until cooked. In ice, meat can be preserved for an unlimited period, and the supposed tendency to rapid decomposition after thawing appears to have been exaggerated. It is, however, certain that frozen meat loses about 10 per cent. more in cooking than freshly-killed meat. Large quantities of meat are now imported from America and Australia in refrigerating chambers. The refrigerating chamber is now an essential part of the equipment of ocean-going steamers, and thanks to it passengers can now be provided with fresh provisions all through the voyage.

"The refrigerating apparatus plays an important part in passenger economy on board the ships of the Orient line.* In specially constructed chambers, meat and vegetables can be kept for any length of time without damage, and the passengers of all classes have fresh food at all times without the disagreeable odours which used to accompany the livestock pens in use before the chambers were fitted. The principle on which the freezing chamber is contrived is one of the most curious examples of the application of a scientific theory to a practical purpose. To endeavour to explain it in unscientific language, let us state what has long been known, that a certain quantity of heat, a quantity perhaps not to be felt, is in all air. This heat keeps the air at a certain bulk, and the more heat there is the more the air expands. This is, of course, within the experience of every one. To make use of the fact for refrigerating purposes, air is pumped into a chamber, and so compressed. The temperature of the

* "The Orient Guide." Description of freezing machines by Mr. Andrew Brown, the Orient Company's Superintendent Engineer.

spray, which further reduces it in temperature, after which the moisture which it has acquired is taken from it in a series of drying pipes, surrounded by air returning from the chambers. The compressed air thus cooled and free from moisture, goes then to the expansion cylinders, where it gives out during expansion part of the work expended in compressing it, in helping to drive the machine. It is then in a condition to enter the storage chambers at a temperature of about 80 degrees below zero Fahr., or about 120 degrees of frost, and entirely free from moisture.

"Besides preserving fresh meat and vegetables, sweet milk and fresh butter are stored for use when wanted, wines are cooled before being supplied, and large quantities of ice are daily made for passengers' requirements in hot weather.

"From Australia, 5,000 to 10,000 carçases of mutton can be brought to the London market in the insulated cargo chambers of each steamer, while lately, fruits of various kinds have been successfully carried during the hottest season of the year."

4. And lastly, there is the method of preservation by antiseptic chemical agents, a method which is often combined with one of the others. Salting and smoking, associated often with drying, represent the earliest efforts in this direction. Salting is one of the oldest methods of preserving meat; a small quantity of saltpetre is usually added to the common salt to preserve a red colour in the flesh. Smoking is usually applied *after* salting. The creasote and other constituents of the smoke penetrate the substances exposed to it, and exercise a highly antiseptic and preservative action upon it. A certain amount of drying and coagulation of the albumen on the surface occurs at the same time.

One of the great objections to salting is that a portion of the salts and extractives, and a considerable

application of sugar to the surface, are also common expedients for preserving both animal and vegetable foods.

There are many other antiseptic agents used for preserving food, such as the *vapour of sulphur*, the meat being placed in a close vessel in which sulphur is burnt; or *charcoal*, which is dusted over its surface; or *strong acetic acid;* or *calcium disulphide;* or *weak carbolic acid.* Injection of *alum* and *chloride* of aluminum into the blood-vessels will preserve meat for a long time; water should be injected first and the antiseptic solution afterwards. Borax, boric acid and salicylic acid have all been used for the preservation of food.

Aseptin, a powder, and *Aseptin amykos,* a liquid Swedish nostrum, used in the preservation of food, both owe their antiseptic properties to boric acid. This acid is also used largely in England and other countries for preserving milk. It is regarded by most authorities as harmless. A substance termed *Boroglyceride,* a preparation patented by Barff in England and Le Bon in France, is made by heating together boric acid (62 parts) and glycerine (92 parts). It forms a tough, deliquescent mass, readily soluble in water and alcohol; and in solution in water in the proportion of one to forty it is extensively used as an antiseptic for the preservation of meat, fish, milk, and other food. Another substance termed *Glacialin* has been recommended for the same purpose; this consists of borax, boric acid, sugar and glycerine.

Much discussion has taken place, especially on the Continent, as to the propriety of allowing salicylic acid to be used for the preservation of wine, beer, milk, fish, meat, fruit and other food substances; and the decision has been almost universally against its use as being distinctly injurious to the healthy organism.

should be poured into ice-cold water. Salt is used very largely in the preservation of butter; it checks the decomposition of the casein which is present and so preserves the butter from decay. Sugar will also exert the same influence, and butter immersed in syrup is said to keep even better than when salted. Butter may also be preserved by excluding it from air, so that merely immersing it in cold water, which should be changed daily, will keep it fresh for a week or more. It is said that a weak solution of tartaric acid or water acidulated with acetic acid (3 grammes to a litre) is far more efficacious, and that butter has been kept fresh for two months by its means at a temperature of 60° to 68°. It should be kept in a closely-covered vessel.

Potatoes.—According to Parkes, sugar, in the form of molasses, is the best substance for preserving potatoes on a large scale; a cask is filled with alternate strata of molasses and peeled and sliced potatoes. On a small scale, boiling the potatoes for a few minutes will keep them for some time. Free exposure to air, turning the potatoes over and at once removing those that are bad, are useful plans. Preserved potatoes have already been described.

Liebig's Extract is a form of *preserved* and *condensed* meat.

It is prepared by subjecting meat entirely freed from tendons and fat to a moderate heat for some time until a viscid dark extract is obtained which contains the salts, creatin, and other organic nitrogenous substances. Mixed with warm water, it forms a nutritious and palatable fluid. One pound of mutton gives about two-fifths of an ounce of extract. It has no tendency to decomposition and will keep unaltered for years. Other extracts of meat resemble it more or less in composition.

Liebig's extract has been found remarkably

CHAPTER VIII.

THE SCIENTIFIC BASIS OF DIETARIES AND RATIONS.

THE object of food is, as we have seen, to repair the waste and to minister to the growth of the bodily organs: to maintain a nutritive equilibrium between the bodily income and expenditure under all the varying conditions and circumstances to which the human organism may be exposed; to maintain all the functions of the body in healthy activity, and to prevent any loss of the normal body-weight. In the determination of a dietary or dietaries adequate to all these purposes, in the selection of suitable kinds and sufficient, but not excessive, amounts of food, experience has shown that it is not altogether safe to trust merely to the sensation of hunger or to the voluntary choice or desires of individuals. Such a reliance might lead to injurious over-indulgence on the one hand, and serious insufficiency on the other. It is therefore necessary that we should be provided with some accurate scientific data, which shall furnish a secure basis for the construction of the various diet scales and rations appropriate to the many varying periods and conditions of human life.

The practical considerations associated with this investigation are of the greatest general importance and interest, for they include the determination of such questions as the food of the soldier at home and in the field; the food of convicts in strict confinement and engaged in hard labour; of the inhabitants of various public institutions, such as schools, asylums, hospitals, etc.; the appropriate food in childhood, growing youth, and maturity in the different sexes; in sickness and in health; in different occupations, climates, etc.

different persons were: first, physical development and body-weight; and second, the amount of work performed. In short, as might readily be supposed, a strong, well-developed man in active work required much more food than a small feebly-developed man leading an idle life.

The three following tables are abstracted from those given by Bauer as representing the results of Pettenkofer's and Voit's experiments to show the incoming and outgoing in the case of a powerful man weighing 69·5 kilos. (1) in a state of rest; and (2) during work; and (3) for purposes of comparison in a small and ill-nourished man during rest and with a liberal diet.

1.—INCOME AND OUTPUT WITH AN ABUNDANT DIET AND DURING REST.*

Income.

Meat	139·7	grammes.
White of Egg	41·5	"
Bread	450·0	"
Milk	500·0	"
Beer	1025·0	"
Suet	70·0	"
Butter	30·0	"
Starch	70·0	"
Sugar	17·0	"
Salt	4·2	"
Water	286·3	"
Oxygen from Air	709·0	"
Total	3342·7	"

Output.

Urine	1343·1	grammes.
Fæces	114·5	"
Breath	1739·7	"
	3197·3	"
Balance +	145·4	"

* Bauer, "Dietary of the Sick." It has not been thought necessary to reproduce all the details of the chemical analysis of the various foods consumed.

3.—Income and Output in a Small Ill-nourished Man, with an Abundant Diet during Rest.

Income.

Meat	151·1	grammes.
White of Egg	61·8	„
Bread	450·0	„
Milk	509·6	„
Beer	1012·7	„
Suet	58·8	„
Butter	30·0	„
Starch	70·0	„
Sugar	17·0	„
Salt	4·3	„
Water	41·4	„
Oxygen from the Air	600·7	„
Total	3007·4	„

Output.

Urine	1069·6	grammes.
Fæces	137·1	„
Respiration	1597·8	„
	2804·5	„
Balance +	202·9	„

As the result of these experiments, Voit fixed for the average daily needs of a moderate worker 118 grammes of albumen (nitrogen 18·3 and carbon 63) and 265 grammes of carbon, either in the form of fats or carbo-hydrates, making a total of 328 grammes of carbon.

The estimate given by Dujardin-Beaumetz* agrees

* According to Dujardin-Beaumetz, a man loses, in connection with the processes of nutrition, nitrogen, carbon, water, and salts. In twenty-four hours these losses, *on an average*, amount to 20 grammes (300 grains) of nitrogen, 310 grammes (4,650 grains) of carbon, 30 grammes (450 grains) of salts, and 3 litres (about 6 pints) of water. The chief part of the nitrogen (14·5 grammes) passes away in the urine in the form of urea and uric acid, and the remainder (5·5 grammes) in the fæces, perspiration, and mucous discharges. Of the carbon, 250 grammes are consumed in the lungs, 45 grammes are eliminated by the kidneys, and 15 grammes in the other secretions. The water passes off by the skin, lungs, kidneys and bowels. A man's food must contain the elements necessary to repair these incessant losses.—"L'Hygiène Alimentaire."

To this should be added:

In Air respired .	744·11	grains of oxygen.	
Water . . .	2818·0	„	„
Salts . . .	32·0	„	„

The whole is equal to $3\frac{1}{2}$ kilos. = 7 lb., *i.e.* about $\frac{1}{20}$th of the body-weight; so that about 6 per cent. of the water, about 6 per cent. of the fat, about 1 per cent. albumen, and about 0·4 per cent. of the salts of the body, are daily transformed within the organism.

Output or Expenditure.

	Water.	Carbon.	H.	N.	O.
By Respiration . .	330	248·8	—	?	631·15
„ Perspiration . .	660	2·6	—	—	7.2
„ Urine . . .	1700	9·8	3·3	15·8	11·1
„ Fæces . . .	128	20·0	3·0	3·0	12·0
	2818	281·2	6·3	18·8	661·45

To this is to be added: 298 grammes of water formed in the body by the oxidation of hydrogen. These 298 grammes of water = 34·59 H. and 263·41 O. 26 grammes of salts are given off in the urine, and 6 by the fæces.

At the time when it was believed that the amount of mechanical work performed by the organisms required the consumption of a corresponding amount of albuminates, a due supply of albumen was regarded as of the first importance in enabling the body to develop functional activity or muscular force; and it was a matter of common observation that persons who were habitually called upon for great exertion were accustomed to take large quantities of albuminous food. But since it has been established that the most strenuous muscular labour

Voit has expressed surprise at Playfair's estimates of the quantity of albumen (57 and 71 grammes) in the first two cases, and he considers them far too low, unless for individuals of unusually small physique.

Parkes also points out, with regard to the subsistence diet of Playfair, that, while calculated as sufficient for the internal mechanical work of the body, it may be doubted if an average man could exist on it without losing weight, as it supposes absolute repose; and he regards the "rest" diet as probably the minimum for an adult male of average size and weight (150 lb. = 67 kilos).

Comparing the estimates of various authorities, Parkes has drawn up the following table of

Standard Daily Diets for a Man in Ordinary Work.

If we compare these with Playfair's diets, we notice a great discrepancy in the estimation of the requisite amount of fats. Either Playfair's must be defective, or the others excessive in this alimentary principle. It is true that in the *working* diets of Playfair the deficiency in fats is attempted to be compensated for by an excess of carbo-hydrates; but it is doubtful if the carbo-hydrates can advantageously take the place of fats to this extent in ordinary diets.

Beyond 300 foot-tons (or 100,000 kilogramme-metres) the additions would require to be greater.

The following is another useful table (from Parkes also), "compiled from, in most cases, several analyses by different authors," *for calculating diets.* From such tables of mean composition the four classes of alimentary principles in any diet, the articles of which are known, may be calculated. Such tables are, of course, merely approximative; "they are very useful as giving a general idea of diet, although they are not accurate enough to be used in physiological inquiries."

Articles.	In 100 parts.				
	Water	Albuminates.	Fats.	Carbo-hydrates	Salts.
Meat of best quality, with little fat, like Beef-steaks.	74·4	20·5	3·5	—	1·6
Uncooked Meat of the kind supplied to soldiers, Beef and Mutton . . .	75	15	8·4	—	1·6
Uncooked Meat of fattened cattle, calculated from Lawes' and Gilbert's experiments. These numbers are to be used if the meat is very fat . . .	63	14	19	—	3·7
Cooked Meat, roast, no dripping being lost. Boiled assumed to be the same .	54	27·6	15·45	—	2·95
Corned Beef (Chicago) .	40	40	15	—	5
Salt Beef (Girardin) . .	49·1	29·6	0·2	—	21·1
Salt Pork ,, . .	44·1	26·1	7·0	—	22·8
Fat Pork (Letheby) . .	39·0	9·8	48·9	—	2·3
Dried Bacon ,, . .	15·0	8·8	73·3	—	2·9
Smoked Ham (König) .	27·8	24·0	36·5	—	10·1
Horseflesh ,, . .	74·3	21·7	2·6	—	1·0
White Fish (Letheby) .	78·0	18·1	2·4	—	1·0
Poultry	74·0	21·0	3·8	—	1·2
Bread, White Wheaten, of average quality . .	40	8	1·5	49·2	1·3
Wheat Flour, of average quality	15	11	2	70·3	1·7

the best parts. The quantity of water in the remaining 9·6 oz. will be $\frac{75 \times 9{\cdot}6}{100} = 7{\cdot}2$, and the water-free solids will be 2·4 oz. The albuminates will be 1·44 oz., the fats ·8064 oz., and the salts ·1536 oz." (*Parkes.*)

It is difficult to estimate the value of salt beef and pork, as much of the nutritive matters passes out into the brine. This has been estimated at as much as from one-third to one-half. It appears that myosin is soluble in a 10 per cent. solution of chloride of sodium; therefore a large proportion of the substance necessarily passes into the brine. "Analyses show, it is true, a large percentage of fibrous and cellular tissue in salt meat, but this is made up of indigestible nitrogenous substances, which afford, probably, little real nutritive material. Perhaps salt beef may be reckoned as equal to two-thirds the quantity of fresh beef; this estimate is certainly quite high enough." (*Parkes.*)

If we again refer to the table of "standard daily diets" we shall be able to ascertain the relative proportion of the nitrogenous to the non-nitrogenous substances in them; it will be found to be about 1 part of nitrogenous to 3½ to 4 of non-nitrogenous substances, *e.g.*:—

	Moleschott.	Pettenkofer and Voit.	Ranke.	Mean.
Albuminates .	100	100	100	100
Fats . .	65	87	100	84
Carbo-hydrates	315	258	240	271
Salts . .	23	22	25	23

If it is required, as may sometimes be the case, to calculate the amount of nitrogen and carbon, as well as that of hydrogen and oxygen in the constituents of any diet, Parkes gives two methods by which this may be done.

Substance.	One ounce (= 437·5 grains) contains in its natural state in grains—					
	Water	Nitrogen.	Carbon capable of being oxidised.	Hydrogen capable of being oxidised.	Sulphur capable of being oxidised.	Salts
Uncooked Fat Meat (Beef) .	276	9·6	94	10·9	1·1	16
Cooked Meat .	236	19·0	110	11·0	2·2	13
Corned Beef (Chicago) . .	175	27·6	135	12·1	3·2	21
Salt Beef . .	215	20·4	63	3·9	2·4	92
Salt Pork . .	193	18·0	79	6·8	2·1	100
Fat Pork . .	170	6·8	185	24·8	0·8	10
Dried Bacon .	66	6·1	205	36·8	0·7	12
Smoked Ham .	122	16·6	174	20·6	2·0	44
Horseflesh . .	325	15·0	55	4·0	1·7	4
White Fish .	341	12·5	48	3·7	1·5	—
Poultry . .	324	14·5	57	4·5	1·7	5
Bread . .	173	5·5	116	1·7	0·6	5
Wheat Flour .	66	7·6	166	2·4	0·9	7
Biscuit . .	35	10·8	180	2·6	1·3	7
Rice . . .	44	3·5	175	3·3	0·4	2
Oatmeal . .	66	8·7	168	4·8	1·1	13
Maize. . .	69	7·0	169	1·4	0·8	6
Macaroni . .	57	6·2	169	2·9	0·7	3
Millet . .	54	7·8	166	2·5	0·9	10
Arrowroot . .	57	0·5	162	—	—	—
Peas (dried) .	66	15·2	156	3·9	1·7	10
Potatoes . .	324	1·4	45	0·4	0·2	4
Carrots . .	372	1·1	20	0·4	0·1	4
Cabbage . .	398	1·2	17	0·5	0·1	3
Butter . .	26	0·2	312	43·7	—	12
Eggs . . .	322	9·3	68	7·4	1·1	4
Cheese . .	161	23·2	153	16·0	2·7	24
Milk (sp. gr. 1·029 and over)	380	2·75	30	2·3	0·3	3
Cream . .	289	1·9	100	13·1	0·2	8
Skimmed Milk .	385	2·8	24	1·2	0·3	3
Sugar . .	13	—	178	—	—	2
Pemmican . .	31	24·4	250	31·1	2·7	8

It has been stated that the standard daily diet of an adult man in ordinary work should contain 20 grammes of nitrogen and 300 grammes of carbon: this would be equal to 308·6 and 4,629 *grains*. In order to use the above table Parkes gives the following estimate in *grains*, founded on Moleschott's standard:—

Nitrogen	317 grains.
Carbon	4,750 „
Hydrogen	202 „
Sulphur	24 „
Salts	461 „

Some range, however, is necessary to adapt a diet to different persons under varying circumstances. For adult men the *usual* range is from 250 to 350 grains (17 to 23 grammes) of nitrogen, and the *extreme* range 140 (mere subsistence estimate of Playfair) to 500 grains (very great exertion) or 9 to 33 grammes.

Ill-fed London needlewoman, according to E. Smith's observations,

had	135	grains of nitrogen, and	3,271 of carbon.
Irish farm labourers . .	349	„ „ „	6,195 „
And operatives during Cotton famine in Lancashire	180 to 200	„ „	3,900 to 4,300 „
Prisoners on light labour (Wilson) . . .	224	„ „ „	4,651 „
Prisoners on hard labour (Wilson) . . .	255	„ „ „	5,289 „
(*On this diet they lost weight.*)			
Military prisoners with hard labour . .	281	„ „ „	5,373 „
(*On this diet they also lost weight.*)			
Military prisoners in India.	300	„ „ „	5,300 „
(*These did not lose weight.*)			

The amounts of carbon range in various diets from about 3,500 to 6,000 grains. Pettenkofer's and Voit's observations on two healthy men, on several occasions, in ordinary exercise, showed a daily consumption of 19·82 grammes = 305·8 grains of nitrogen, and Parkes's experiments on four healthy average men in common work showed that they could be maintained in perfect health and uniform weight on a daily allowance of

293 to 305 grains of nitrogen. In the best diets the proportion between the nitrogen and carbon is nitrogen 1 to carbon 15.

The following table, adapted from Dujardin-Beaumetz, also shows the percentage amount of nitrogen and carbon in various articles of food. The hydrogen existing in the compound in excess of what is required to form water with the oxygen present is calculated as carbon. It is only necessary to multiply the nitrogen by 6·5 to obtain the amount of dry proteids in 100 grammes of the fresh food substance :—

	Nitrogen.	C + H. Combustibles calculated as carbon.
Beef (uncooked)	3·00	11·00
Roast Beef	3·53	17·76
Calf's Liver	3·09	15·68
Foie-gras	2·12	65·58
Sheep's Kidneys	2·66	12·13
Skate	3·83	12·25
Cod, salted	5·02	16·00
Herring, salted	3·11	23·00
" fresh	1·83	21·00
Whiting	2·41	9·00
Mackerel	3·74	19·26
Sole	1·91	12·25
Salmon	2·09	16·00
Carp	3·49	12·10
Gudgeon	2·77	13·50
Eel	2·00	30·05
Mussels	1·80	9·00
Oysters	2·13	7·18
Lobster (uncooked)	2·93	10·96
Eggs	1·90	13·50
Milk (Cow's)	0·66	8·00
" (Goat's)	0·69	8·60
Cheese (Brie)	2·93	35·00
" (Gruyère)	5·00	38·00
" (Roquefort)	4·21	44·44

Adopting French weights, and remembering that the average weight of an adult man is 67 kilogrammes, it is easy to apply this table, on the calculation that the daily ration should fluctuate between 6 to 9 grammes of carbon, and 0·250 to 0·360 of nitrogen, for each kilogramme of body-weight.

Advanced age necessitates a considerable reduction in the amount of food allowed, for not only are all the organs, and especially the voluntary muscles (except in certain exceptional instances of unusually vigorous old age) more or less wasted, but the digestive and assimilative functions are far less active, and are unable to digest and utilise the same amount of food as formerly.

In an institution for the widows of beneficed clergymen, Forster found that a number of old ladies were content with an average allowance of 67 grammes of albumen, 38 of fat, and 266 of carbo-hydrates, while others required rather more—viz. 80 grammes of albumen, 49 of fat, and 266 of carbo-hydrates; but both these diets are much richer in albuminates and fats than Playfair's "subsistence diet."

Dujardin-Beaumetz regards the following as a fair basis for the estimation of the average daily dietary of an adult man:—124 grammes of albuminates, 430 grammes of carbo-hydrates, 55 grammes of fat; this would correspond with a bread and meat ration of—

819	grammes	(about 28 oz.)	White Bread.
259	„	(about 9 oz.)	Meat.

Economical reasons may occasionally require that we should cut down the dietary to the lowest level compatible with the maintenance of healthy existence; but it is always advisable when practicable to allow a certain excess over and above the strict physiological necessities. The effects of a *deficient* diet are usually not slow to make their appearance. They are—loss of weight; a lowered capacity for exertion and functional

activity; often an unhealthy, cachectic aspect, and a diminished power of resistance to unfavourable influences, so that during periods of famine or enforced privation the rate of mortality rises enormously. The consequences of immoderate feeding and of habitual excess are frequently also sufficiently conspicuous. In many cases an unusual, unequal, and unsightly deposition of fat takes place in connection with the abdominal and other organs, together with disturbances in the functions of the liver and other organs of digestion. But apart from the deposition of fat, which is not an invariable consequence, excess of food leads to retarded metabolism and imperfect nutritive changes, indicated sometimes by the presence of uric acid deposits, of oxalates in the urine, of an excessive excretion of urea. The disturbances of metabolism which lead to these deposits are as yet, however, only imperfectly understood; but there is a vast deal of evidence which points to immoderate feeding as one of their common antecedents.

Not only is it important to have due regard to quantity in the construction of dietaries, but it is also equally necessary to have regard to the proportionate *composition* and *quality* of foods. A particular food-stuff may contain all the constituents necessary for the nutrition of the body, but may yet be quite unsuitable to form the *sole* food of the organism, on account of the unfavourable *proportions* in which they may exist in it. Or another food-stuff may contain some or all of the necessary elements of nutrition, but they may not all be digestible and utilisable. These considerations show the necessity of mingling or combining different articles of food in due and proper proportions in the construction of diet-tables.

The following table, which is modified from one by Voit, shows in a striking manner the unsuitableness of many common articles of food to be employed as

the sole constituents of human diet, and the great wastefulness on the one hand and insufficiency on the other which would be involved in the attempt.

In order to yield the necessary daily ration of nitrogen and carbon, the following quantities of the undermentioned articles would be required; for "experience has shown that the diet best suited for the body must contain one part of nitrogenous foods to three and a half or at most four and a half of the non-nitrogenous":—*

	To yield 18·3 grammes Nitrogen.		To yield 328 grammes Carbon.
Cheese	272	Bacon	450
Peas	520	Maize	801
Lean Meat	538	Wheat Meal	824
Wheat Flour	796	Rice	896
Eggs (18)	905	Peas	919
Maize	989	Cheese	1,160
Black Bread	1,430	Black Bread	1,346
Rice	1,868	Eggs (43)	2,231
Milk	2,905	Lean Meat	2,620
Potatoes	4,575	Potatoes	3,124
Bacon	4,796	Milk	4,652
Cabbage	7,625	Cabbage	9,318
Turnips	8,714	Turnips	10,650
Beer	17,000	Beer	13,160

It would be scarcely possible for any individual to consume and digest daily 2,620 grammes (*i.e.* about 90 ounces) of meat, the quantity necessary in order to yield the daily requirement of carbon, while the waste of nitrogen would be prodigious; on the other hand, it would require 4,575 grammes or about 10 lb. of potatoes to yield the daily requirement of nitrogen. And milk, which is the food of Nature's own selection for the infant, would be most wasteful as the sole food for the adult, as he would require 4,652 grammes or 10 pints to furnish the daily supply

* Landois also gives the following table to show how far the foods mentioned therein correspond to these requirements, and how

Carbo-hydrates are not able to minister as completely as the fats do to the functions of tissue growth and repair; while, on the other hand, a large proportion of fat in the food is not, as a rule, well tolerated by the digestive organs for long at a time, unless under exceptional conditions of climate, as amongst the inhabitants of Arctic regions, where food possessing a relatively large capacity for heat-production is especially needed. It is not uncommon, moreover, to find individual peculiarities with regard to the capacity for taking fats, some persons being incapable of digesting but very small quantities; in such cases the deficiency must be supplied by a proportionate allowance of carbo-hydrates.

The force-value of various foods.—Two chief conditions determine the possible amount of force that can be manifested in the body—1st, the amount of potential energy contained in the food, and this may be readily ascertained and expressed in units of heat or of motion; and 2nd, the degree in which the assimilative processes in the body are able to liberate and make use of this energy. An ounce of albumen if burnt in oxygen will yield a certain amount of heat, but no such complete oxidation can occur in the body, for about one-third of the constituents of the albumen is excreted, incompletely oxidised, in the form of urea. It is different with some of the carbo-hydrates, and a soluble carbo-hydrate, like sugar, is completely oxidised within the body and converted into carbonic acid and water, so that its *actual* energy in the body is equal to its theoretical energy.

It has been calculated (*Parkes*) that

				Foot-tons of potential energy.
One ounce of dry		Albuminate	yields	173
„	„	Fat	„	378
„	„	Starch	„	138
„	„	Cane Sugar	„	131
„	„	Lactin or Glucose	„	124

Energy developed by 1 oz. of the following foods when oxidised in the body:—

Food Stuff.	With usual percentage of water.	One ounce water-free.
	Foot-tons.	Foot-tons.
Beef uncooked	48·5	199
Meat "	57·8	243
Beef, "	96·0	280
Meat, *cooked*	102·6	[illegible]
Corned Beef (Chicago) . .	124·0	217
Salt Beef	52·0	138
" Pork	71·6	166
Fat "	202·0	336
Dried Bacon	292·3	346
Smoked Ham	179·6	267
Horseflesh	46·4	189
White Fish	44·3	209
Poultry	50·7	[illegible]
Bread	87·5	147
Wheat Flour	123·6	146
Biscuit	173·3	[illegible]
Rice	126·5	141
Oatmeal	130·0	154
Maize	132·0	160
Macaroni	122·7	146
Millet	125·9	149
Arrowroot	116·4	138
Peas (dried)	118·9	151
Potatoes	33·0	141
Carrots	14·3	137
Cabbage	13·0	158
Butter	344·5	367
Eggs	67·3	265
Cheese	149·9	245
Milk (Cow's), new . . .	26·9	225
Cream	109·2	365
Skimmed Milk	20·4	181
Sugar	126·4	[illegible]
Pemmican	270·1	293
Ale (Bass's bottled) . . .	30·0	260
Stout (Guinness)	41·5	360

The advisability, in arranging dietaries, of avoiding monotony and providing variety in food should never be forgotten; for the digestibility, and therefore the nutritive value, of food depends greatly on its palatableness, and the stimulus thereby given to the digestive secretions.

CHAPTER II.

CERTAIN DIETARIES—PRISON DIETARIES—SOLDIERS' DIETARIES—SEAMEN'S DIETARIES.

We may now examine with advantage certain dietaries, especially those adopted in prisons and in the army and navy. Amongst the other advantages attending the transfer of the local prisons to Government has been the adoption of an uniform and improved dietary for prisoners. The Commissioners of Prisons in their Eleventh Report (1887-88) allude to the results of the adoption of the recommendations of the committee appointed in 1878 for establishing uniformity in the diet of prisoners in all prisons as entirely satisfactory, and as having "fulfilled the object it was intended to serve," in evidence of which they mention "the low rates of sickness and mortality, referred to later on, which would be incompatible with an insufficient amount of food, or a diet not composed of the proper ingredients;" and they subsequently cite the following facts as proof of the improvement in health of the inmates of local prisons since 1878:—"The yearly average death-rate for the 16½ years ended the 31st of March, 1878, was 11·6 per 1,000, while for the ten years ended 31st March, 1888, it was 8·1." They claim the "great merit of simplicity and economy" for the dietary now adopted, and they state that they "have every reason to believe it furnishes sufficient, and not more than sufficient, amount of food to all persons who are subject to it. Reports received from the medical officers of the principal prisons where it has been in use entirely corroborate" this belief.

The view of prison-life taken by the Committee who undertook to report on the subject of prison dietaries is certainly somewhat optimistic, but it

"The distinction between the diets of men with hard labour on the one side, and that of men without hard labour and of women on the other, consists in a deduction of one-fifth of the solid articles, and one-sixth of the whole, the difference being equally distributed in the course of the week between the nitrogenous and non-nitrogenous elements." And with regard to female prisoners they observe, "the demands made upon their physical energies are practically much the same whether the sentence be with or without hard labour. Their employments are not such as to admit of that sharply drawn distinction between hard labour and light labour which is possible among the males; there is not the same inequality in the expenditure of energy; and differences of diet founded upon distinction as to labour, which are for the most part hypothetical, are apt to be a source of injustice, and to give rise to bickering and jealousy. We therefore recommend that in the respective classes the diet distinction be one and the same for all women, whether with or without hard labour."

For Class IV., *i.e.* prisoners undergoing more than four months' imprisonment, the dietary adopted is the following:—

			Men with hard labour.	Men without hard labour and Women.
BREAKFAST	Daily	Bread	8 ounces	6 ounces
		Porridge	1 pint	—
		Gruel	—	1 pint
DINNER	Sun. & Wed.	Bread	6 ounces	4 ounces
		Potatoes	8 "	8 "
		Suet Pudding	12 "	10 "
	Mon. & Fri.	Bread	8 "	6 "
		Potatoes	12 "	10 "
		Cooked meat without bone	4 "	3 "
	Tues., Thurs., & Sat.	Bread	8 "	6 "
		Potatoes	12 "	10 "
		Soup	1 pint	1 pint

DIAGRAM TO SHOW APPLICATION OF PROGRESSIVE PRINCIPLE.

Term.	Class I.	Class II.	Class III.	Class IV.
Seven days and under	Whole term.	—	—	—
More than seven days and not more than one month . .	Seven days.	Remainder of term.	—	—
More than one month and not more than four months . .	—	One month.	Remainder of term.	—
More than four months	—	—	Four months.	Remainder of term.

For making the bread, *whole meal* is recommended to be employed, which contains all the constituents of the grain, except "the outer and highly silicious envelope of which the coarse bran is composed." In order to avoid the *heaviness* which bread made from whole meal is apt to present, the following directions as to the method of preparing the dough are given :—

"If, in the manufacture of bread, the whole meal be subjected to the same treatment as ordinary flour, the result will be a somewhat heavy loaf, owing to the presence in all the envelopes of a ferment termed 'cerealin.' This ferment is analogous to the diastase of malt, and, under certain conditions, exerts an energetic influence on starch, giving rise to a compound of dextrin and sugar, which by its viscidity prevents the dough from being sufficiently puffed up by the carbonic acid generated in the process of fermentation. In order to avoid this inconvenient action

and nearly cooked. The peas should be boiled gently; and the fresh vegetables, divided into small pieces, should be boiled or steamed. The whole should then be mingled together, and gently simmered until ready. Lastly, add the pepper and salt. Care should be taken that none of the ingredients are so over-cooked as to be imperceptible in the soup." The proportions are: In every pint, 4 oz. of clod (or shoulder), cheek, neck, leg, or shin of beef; 4 oz. of split peas; 2 oz. fresh vegetables; 1½ oz. onions; pepper, and salt.

"**Suet pudding.**—Each pound contains 1½ oz. mutton suet, 8 oz. of flour, and about 6½ oz. of water.

"**Potatoes.**—The entire absence of vegetable acids from a prison dietary would result, as is well known, in an outbreak of scurvy, and the potato is chiefly valuable as supplying the anti-scorbutic element in its cheapest form. This vegetable is characterised by a very large percentage of starch, which is of the same nutritive value as starch obtained from other sources. Within and surrounding the cells is a fluid or juice, the albuminous constituents of which are coagulated during the process of cooking. The watery part of this juice is absorbed by the starch granules, which swell up and distend the cells in which they are contained, so that they no longer adhere together, and the result is the loose, flocculent mass which is described as a 'floury' or 'mealy' potato. Unless the potato be properly cooked, the fluid referred to is only partially absorbed, the cells do not become sufficiently distended and separated, and the potato is then described as 'waxy' and 'dense.' In this condition it is not digested, and consequently does not furnish to the system the anti-scorbutic principle in which resides its chief value as an article of diet."

The **gruel** is made with 2 oz. of coarse Scotch oatmeal to the pint, with salt, and one of its advantages

be ordered is not to exceed fifteen days. No task of labour is to be enforced on any one of the nine days on which the bread and water constitute the sole food supplied to the prisoner."

The "Stirabout Diet" referred to is as follows:—

1st.—For Men and Women performing a Daily Task of any Labour not expressly defined as Hard Labour.

BREAKFAST . .	Bread, 8 oz.
DINNER . .	1 pint of Stirabout, containing 2 oz. of oatmeal and 2 oz. of Indian meal, with salt. Potatoes, 8 oz.
SUPPER . .	Bread, 8 oz.

"This diet to be limited, in the first place, to twenty-one days; after that, the diet of the class to which the prisoner belongs for one week before its repetition, when it is to be limited to fourteen days. The entire period, including the interval, for which any single term of this diet may be ordered is not to exceed forty-two days."

2nd.—Full Stirabout Diet for Men performing a Daily Task of Hard Labour.

BREAKFAST . .	Bread, 8 oz.
DINNER . .	1½ pint of Stirabout, containing 3 oz. of oatmeal and 3 oz. of Indian meal, with salt. Potatoes, 8 oz. Bread, 8 oz.
SUPPER . .	Bread, 8 oz.

"This diet to be limited, in the first place, to forty-two days; after that, the diet of the class to which the prisoner belongs, for fourteen days before its repetition, when it is to be limited to twenty-eight days. The entire period, including the interval, for which any single term of this diet may be ordered is not to exceed eighty-four days."

The amount of the proximate aliments (as water-free solids) in each diet, as well as the amount

(b) Men with Hard Labour.

Albuminates	3·27 oz.	(92·7 grammes)
Carbo-hydrates	16·65 „	(472·0 „)
Fats	0·98 „	(27·9 „)
Mineral	1·31 „	(37·1 „)

Nitrogen.	*Carbon.*
0·49 oz. (13·7 grammes).	10·40 oz. (295·0 grammes).

CLASS IV.

(a) Men without Hard Labour, and Women.

Albuminates	3·23 oz.	(91·5 grammes)
Carbo-hydrates	15·51 „	(440·0 „)
Fat	1·00 „	(28·35 „)
Mineral	1·27 „	(36·00 „)

Nitrogen.	*Carbon.*
0·49 oz. (14·0 grammes).	9·84 oz. (279·0 grammes).

(b) Men with Hard Labour.

Albuminates	4·09 oz.	(116·0 grammes)
Carbo-hydrates	20·17 „	(572·0 „)
Fat	1·30 „	(37·0 „)
Mineral	1·55 „	(44·0 „)

Nitrogen.	*Carbon.*
0·61 oz. (17·0 grammes).	12·78 oz. (362·3 grammes).

On examination of these diets, it will be seen that Class I. contains about the same quantities of the several alimentary substances as are contained in Playfair's subsistence diet; and as it is only applicable to the short period of seven days, its defects are not likely to be attended by any serious consequences unless prisoners are set to "hard labour" when on this diet. For this it is quite inadequate, even for so short a period; and, as the offences for which such short sentences are considered a sufficient punishment are of the most trivial nature, there seems to be no good reason for insisting on such a highly *correctional* dietary for these the least criminal of offenders.

Prison Diet, Class II.		Mean of several Diets (Parkes).	Deficiency.
	grammes.	grammes.	grammes.
Albuminates . .	70·8	122	51·2
Carbo-hydrates .	385·5	332	(+ 53·5)
Fats . . .	21·0	100	79·0
Salts . . .	32·3	28	(+ 4·3)

As has been already pointed out, the effects of such a dietary could only be accurately estimated by statistics of the health of prisoners *after their discharge* from such short terms of imprisonment.

The hard labour diets of Classes III. and IV. appear ample, even when compared with the liberal estimate of Moleschott, except that they are very defective in fats, which defect can scarcely be compensated for by the relative excess of carbo-hydrates.

Prison Diet : Class III. and Class IV.			Moleschott's.
	grammes.	grammes.	grammes.
Albuminates . .	92·7	116·0	130
Carbo-hydrates .	472·0	572·0	404
Fats . . .	27·9	37·0	84
Salts . . .	37·1	44·0	30

These diets would certainly be improved by increasing the proportion of fats and diminishing the carbo-hydrates to a corresponding amount.

In connection with these prison diets, Dr. de Chaumont's remarks on the effect on soldiers of imprisonment in convict prisons particularly are interesting. He says, referring to the circumstance that soldiers are sometimes, as a matter of convenience, confined in convict prisons: "The ordinary diet . . . .

Articles of Food.	Quantity.	Water.	Albuminates	Fat.	Carbo-hydrates	Salts	Total Water-free Food.
	oz.						
Meat (¼ bone)	12·00	7·20	1·44	0·81	—	·15	2·40
Bread	24·00	9·60	1·92	0·36	11·81	·31	14·40
Potatoes	16·00	11·84	0·32	0·02	3·36	0·2	3·72
Green or other Vegetables	8·00	7·28	0·14	0·04	0·46	0·6	0·70
Milk	3·25	2·82	0·13	0·12	0·16	0·2	0·43
Sugar	1·33	0·04	—	—	1·29	—	1·29
Salt	0·25	—	—	—	—	·25	0·25
Coffee	0·33	—	—	—	—	—	—
Tea	0·16	—	—	—	—	—	—
Total quantity	65·32	38·78	3·95	1·35	17·08	·81	23·19

Calculating out the nitrogen, carbon, etc., in these substances, we get:—

Nitrogen		272 grains.
Carbon in Albuminates	837	4,588 "
" Fats	454	
" Carbo-hydrates	3,297	
Hydrogen in Albuminates	51	116 "
" Fats	65	
Sulphur in Albuminates		32 "

To compare it with Moleschott's standard diet, we must state the quantities in grammes.

	Moleschott's.	English Soldier's Diet.
	grammes.	grammes.
Albuminates	130	113
Fat	84	38
Carbo-hydrates	404	482
Salts	30	23

are sufficient in themselves, "but whether these supplies, supplemented by other articles provided out of the messing stoppage, afford a sufficient diet for the soldier." The evidence of the manager of Pearce's Dining and Refreshment Rooms, an institution supplying about 30,000 meals daily to carmen, bricklayers, etc., in London, showed that the average amount of meat without bone supplied to each man for dinner was 5 oz. uncooked, yielding when cooked about 4 oz.

According to Brigade-Surgeon Maunsell, who weighed 1,232 rations, the average amount of cooked meat supplied daily to the soldier was 7 oz. 1 dram, exclusive of bone and dripping.

The Report also points out that the British soldier receives a larger meat ration than any Continental soldier, and that with the existing scale of diet recruits almost invariably increase in weight.

The most interesting and practical part of the Report, to which we shall return immediately, is that which refers to the considerable success which has attended the experiments of Colonel Burnett of the 1st Battalion Royal Irish Rifles at Mullingar, for supplying his men with what Surgeon-Major Notter, Professor of Military Hygiene at Netley, has described as a model diet, with a stoppage of only 3d., instead of 5d., a day. This system, or one somewhat similar, appears also to exist in many other regiments. Complaints as to the quality of the bread supplied to the army, the Report states, were almost universal and well-founded. It was often imperfectly baked and became stale and sour within a few hours of its issue. Large quantities of ration bread were thrown away by the troops and other bread was purchased in its place. Two qualities used to be supplied—(1) Hospital bread made of "Households No. 1" flour, and (2) Ration bread made of "London seconds" flour. The defect in the bread was believed to be due to the use of

sufficient diet. They object to frozen meat, as it loses 10 per cent. more in cooking than fresh meat; and to the suggestion that fish and pork might form part of the Government ration as an occasional substitute for beef and mutton, they reply that the former is impracticable for general application, owing to the cost of the more nourishing kinds of fish, and the difficulty of insuring fresh supplies at inland stations; and as to the latter, there would be great difficulty in insuring a thoroughly good supply of healthy meat. The cost of adopting the recommendation of the Committee to use "No. 1 households" instead of the flour now used, and baking 2 lb. instead of 4 lb. loaves, will be £11,200.

In an appendix to their Report the Committee publish a Memorandum from Colonel C. J. Burnett setting forth the "innovations and improvements" he has made in the messing and rations of the men under his command. Having "formed the conclusion that the quantity of bread and meat at present issued to the soldier was sufficient, if carefully and judiciously looked after," he resolved to put his ideas into practice and to ascertain if he had formed a correct judgment or otherwise. He turned his attention first to the principal meal, the dinner. "I found," he says, "that, although it appeared sufficient, still something seemed wanting in it, for many of the men after this meal adjourned to the canteen—a course which, I reasoned, they would not follow had their appetites been thoroughly satisfied at the dinner table. It struck me that a basin of good soup would be the requisite thing in this case, and I accordingly took measures to give it a trial, without causing any extra expense to the soldier. To do this, I had the bones separated from the meat in the cook-houses and crushed, and each lot weighed and recorded to prevent any undue waste.

"The first morning this was done I directed each

them, I would here state that since the introduction of the soup I have not had a single complaint regarding the quality or quantity of his meat from any man of the battalion. The system is now fairly established in the battalion, and irrespective of the nature of the man's dinner, he is supplied with a basin of good wholesome soup in addition.

"Having made this improvement in the men's dinners, I next turned my attention to their breakfasts, which hitherto had been supplied to them in strict accordance with the scale laid down in the 'Messing Book' (Army Book 48), any little extra in the shape of butter, cheese, jam, eggs, etc., being purchased by the soldier from his own pocket. My first thought was how to provide him with these extras without encroaching on his pocket, and to do this I knew it would be necessary to make a retrenchment in some direction, without deducting from his other meals. It had always been the custom in the battalion (copied from other regiments on arrival home in 1882) to provide the men with an extra ½ lb. bread at the tea meal. This was paid for out of their messing money, and was familiarly known as 'tea bread.' It is, I believe, provided in most regiments at home. At various times, when making periodical inspections of the barracks, I had noticed that the refuse barrels were more than half full of stale bread, thrown out by the men, and on making close inquiries, I learnt that the ration bread, supplied in the morning, lasted the men for breakfast and dinner, and then left a quantity over for tea. But the men, knowing that they were getting fresh bread of a better quality for tea (the 'tea bread' referred to), made no effort to save or utilise the remnants of their ration loaves, but threw them in large quantities into the refuse barrels. Further, from personal inquiries that I made amongst the men themselves, and from visits which I made to the barrack

took the six cans for the company (in which the tea is carried by the men from the cook-house), and put all the dry tea into one can, filled it up with hot water, and then put the can on the range to 'draw.' These cans are barrack furniture, and are without lids, consequently as the can was open while the tea was 'drawing,' the greater part of the aroma and strength escaped in the steam. After the tea was 'drawn' in this can, it was strained, the leaves taken out and thrown away, the tea poured in in equal parts into the other cans, which were then filled up with hot water, and sweetened with sugar and milk. With the intention of improving this, I ordered lids for the cans to be made in the regimental workshops, at a cost of a few pence each, which I defrayed from the Refuse Fund. When these lids were ready, I thought I would also make an alteration in the method of making the tea, with a view of improving it. Taking a company with about 60 men in it, I found that they were getting 12 oz. tea at 1s. 8d. per lb. = 1s. 3d. Instead of this I obtained 8 oz. tea of a superior quality, at 2s. per lb. = 1s., and instead of having the tea made all in one can, I had the dry tea divided into six equal parts, and put in separately into each can, then 'wetted' with the boiling water, and each can put on the range to 'draw,' properly covered over with lids. When the tea was 'drawn' and sweetened, it was found to be most excellent, and far superior in every way to what they were getting before, besides costing 3d. per diem less. This method, which applies to coffee as well as tea, has now been adopted throughout the battalion.

"Having accomplished so much with the breakfasts and dinners, I thought it my duty to see what could be done in the way of improving the men's tea meal. During many years' service in India, I had always found that the tea meal was not popular

		s.	d.
1	Bullock's Head	1	0
2	lb. Meat	0	8½
1½	stone Potatoes	0	6
	Vegetables	0	3
1	lb. Coffee	0	10
3	lb. Sugar	0	7½
2	pints Milk	0	2½
¼	lb. ration Bread	free	
	Total	4	1½

"(It may not always be easy to procure a bullock's head, but other material in the way of cows' heads, sheep's heads, shin, gravy meat, etc., can in such cases be substituted, and answer the purpose just as well.)

"Need I say that I was surprised myself at the result? The stew was most excellent, and with the basin of coffee and the bread, formed a most comforting and nourishing meal. After the first night the stews were even better, as the cook had stock to work on from the previous night, in addition to the fresh material given him.

"The plan was rapidly adopted by every company in the battalion, and now at the evening meal, instead of finding two or three men sitting down to the table, it is the exception to find any men away from it; and this in itself speaks to the way in which it has been received and appreciated by the men. The suppers have become universal in all the rooms, and it is a most comforting sight every evening, particularly now during the cold winter evenings, to go round the barrack rooms and find the companies, almost to a man, sitting at their supper tables, thoroughly enjoying their warm and nourishing meal.

"Already these changes are beginning to develop habits of thrift in the men. The potatoes remaining over from the dinners, instead of being consigned to the refuse barrels as before, are carefully preserved and used with the suppers at night; scraps of bread

"On taking the ordinary ration we have—

	Ordinary Scale.	Col. Burnett's.
	grains.	grains.
Nitrogen	276	344·447
Carbon	4588	4912·684

"Your system only requires *one* improvement. It is still deficient in *fats*, and if you could add 1 oz. of bacon daily at the cost, say, of ½d., it would be an excellent diet *in every respect.* It would actually provide him [the soldier] with 323 foot-tons of mechanical energy, which means a very good day's work. It is no small honour to have succeeded so far. You have done wonders, and I am sure you will not mind my making this suggestion to you about its not containing quite enough of fat. Butter, bacon, cheese, suet, lard, any of these would supply this, but you want to add about 1 oz. per diem for each man.

"The soup gave a large amount of nitrogen in a good form.

"The standard diet I have given will easily show you where yours is too small, *in fats*, and I am sure you can easily make this improvement."

To this Colonel Burnett replies :—

"I can easily manage the fat, and have done so already for four days in the week, because on two days in the week I give pies and puddings, which contain each 3½ lb. of dripping for 50 men. Then, on one day a week, I give every man 2 oz. of bacon, and, now eggs are cheap, an egg for breakfast. The dripping does not, of course, appear in the grocery book, because I save it from the stews, so it costs nothing. I buy dripping, and give the men 2 oz. one day a week, and I can run to two more ounces of

"H" COMPANY. DAILY MESSING ACCOUNT.

BREAKFAST.

No. of Mess.	No. of Men.	Extras provided.	Amount.		
			£	s.	d.
1	11	Brawn	0	0	10
2					
3	24	Herrings	0	1	4
4					
5	14	Butter	0	1	1
	49		0	3	3

SUPPER—Porridge.

of beef, 2 stone of potatoes, with vegetables and onions, together with the usual basin of coffee, and ¼ lb. ration bread.

Colonel Burnett has succeeded completely in showing that "with the Government ration, supplemented by a stoppage of 3d. per day from the soldier, the demands of science in the matter of feeding the Army can be satisfied," and Dr. Notter adds, "The ration Colonel Burnett issues is ample, and he states he can provide this *anywhere* without extra cost."

For campaigning no strict scale of diet is or can be laid down; it would have to be fixed at the time, and would depend on the character of the campaign. The scale should be very liberal, and besides the *usual* articles of diet, *extras* should be supplied for special purposes, such as forced marches, rapid movements at a distance from the base of supplies, etc. The usual ration should contain at least 375 to 400 grains of nitrogen. Parkes suggests the following as a liberal and varied war ration:—

Bread	1¼ lb.
Fresh Meat, without bone	1 "
Peas or Beans	3 oz.
Potatoes and Green Vegetables	1 lb.
Cheese	2 oz.
Sugar	2 "
Salt	½ "
Pepper	$\frac{1}{20}$ "
Ground Coffee	1 "
Tea	½ "
Red Wine	10 "
Or Beer	20 "

The nutritive value of this diet is about 380 grains of nitrogen and 5,000 of carbon.

As useful extras he mentions salt meat, Australian meat, Chicago meat, dried meat, Liebig's Extract, pea and beef sausages, biscuits, flo[illegible] [illegible]iscuits,

should not be allowed more than a quart of beer a day, and they would be healthier with a pint. In the hot stations and seasons entire abstinence from alcoholic stimulants should be the rule, and tea and coffee should be chosen as the best beverages. The tendency to scurvy, which is greater in the Tropics than at home, points to the desirability and importance of consuming a due proportion of fruit.

Ration of the French soldier.—Dujardin-Beaumetz makes the remarkable statement that the ration of the French soldier is superior to that of the soldiers of other armies, an opinion which another French authority, Prof. Germain Sée, is far from sharing, who points out the superiority of the ration of the British soldier, and expresses great dissatisfaction both as to the quantity and quality of the French soldier's rations.

The State provides the meat at thirty-five per cent. under market price; it also supplies the common bread (*pain de munition*). The white bread (*pain de soupe*) has to be bought by the soldier. For this and other articles of diet he has to subscribe forty-three centimes out of his daily pay of forty-eight centimes, leaving him five centimes, *i.e.* a halfpenny, to receive in cash. His dietary consists of—

	Grammes.	Oz. avoir.
Munition Bread	750	26·4
White Bread (for Soup) . .	260	8·8
Meat (uncooked)	300	10·6
Vegetables (green) . . .	100	3·5
" (dried) . . .	30	1·1
Salt	15	0·5
Pepper	2	(31 grammes)
Total	1·447	51·00

out that at the age when men enter the army as recruits it is a serious error to suppose that their growth is complete. Many parts of the body do not reach their complete and permanent state "till five-and-twenty years of age, or even beyond that period. The young soldier should then, from a nutritive point of view, be regarded as still in the period of growth and development, and his food should, therefore, not only be sufficient to maintain the integrity and activity of his bodily organs, but also contribute to his further growth." *

The German soldier receives a *small* and a *large* ration; the latter he gets when on marches or manœuvres, etc. They consist of the following food substances:—

	Smaller Ration.	Larger Ration.
	oz. av.	oz. av.
Bread	26·50	26·50
Meat (uncooked)	6·00	8·82
Rice	3·20	4·22
Or Unhusked Barley (Groats) .	4·21	5·28
Or Peas or Beans	8·22	10·60
Or Potatoes	53·08	70·50
Salt	0·87	0·87
Coffee	0·468	0·468

Parkes calculates that, when of best quality, these would furnish—

	Albu-minates.	Fats.	Carbo-hydrates.	Salts.	Total Water-free Food.
	oz. av.	oz. av.	oz. av.	oz. av.	oz. av.
Smaller Ration	4·8	1·1	17·4	1·5	24·8
Larger "	5·7	1·4	18·0	1·6	27·3

* Germain Sée, "Du Régime Alimentaire. Régime du Jeune Soldat."

	Albuminates.	Fats.	Carbohydrates.	Salts.	Water-free Food.
In time of peace	3·7	1·6	17·0	1·0	23·3
In time of war average.	4·5	3·2	22·8	1·0	31·5

The peace ration contains too much bread, too little meat and too little fat.

The Russian soldier has 196 meat days and 169 fast days in the year.

On the *meat* days he gets meat and *schtschi* (cabbage soup), and buckwheat gruel; on *fast* days the meat is replaced by peas, and, occasionally, fish. He has a daily issue of 42 ounces of rye bread. The nutritive value of this diet has been estimated as follows, in ounces av.:—

Albuminates.	Fat.	Carbo-hydrates.	Salts.	Water-free Food.
5·8	1·0	25·0	2·5	34·3

On the march he gets 24½ ounces biscuit instead of bread. On rare occasions, brandy, 135 fluid ounces per annum in 5 ounce rations, is served out.

The following is the fresh meat ration of European armies, calculated in ounces avoirdupois,* extracted from a statement prepared by Surgeon-Major J. L. Notter, M.D.:—

England		12·0 oz.
France		10·58 „
Germany	smaller ration	3·80 „
	larger „	8·81 „
Austria		9·87 „
Belgium		8·81 „

* Report of the Committee appointed to inquire into the question of Soldiers' Dietary. Presented to both Houses of Parliament, June, 1889.

cannot be procured, he gets daily either 1 lb. of salt pork, or salt beef, or $\frac{3}{4}$ lb. of preserved meat; and in addition on certain days $\frac{1}{3}$ lb. of split peas, with celery seed to flavour the soup made from them. On other days he gets flour 9 oz., raisins $1\frac{1}{2}$ oz., suet $\frac{3}{4}$ oz., to make into a pudding; and on other days either 4 oz. of preserved potato, or 4 oz. of rice, or 2 oz. of each.

to five hours to digest an average meal; but some meals and certain kinds of food require a longer time than this, while for some kinds of food a shorter period is sufficient. In a growing active youth or a healthy child, fed on appropriate and readily digested food, the digestive process is comparatively rapid, and the intervals between meals should therefore be shorter than in the case of adults. So also in adults leading an active out-of-door life, the food taken at each meal will be digested more rapidly and completely than in the case of persons of middle age following a sedentary occupation.

In Great Britain (with the exception of boys and girls at school who are often required to go too long without food) the tendency no doubt is to eat at too short intervals, and in many cases indigestion arises from the stomach being frequently called upon to commence the digestion of a fresh meal, before it has completed that of the preceding one.

The first meal of the day is *breakfast*, and it is a very important one. In the case of active persons leading wholesome, regular lives, it should be taken as soon after rising as possible. Persons who require to take exercise before breakfast are either dyspeptic or overfed; and, except in such persons, any considerable exertion, without having first taken food, after so long a fast as usually occurs from the preceding meal, is unduly exhausting and calculated to be injurious.

The unfed organism at this period of the day is also very susceptible to morbid influences, and especially prone to take harm from exposure to cold, to infection, or other injurious and depressing agencies.

Of course, for those who prefer to take a substantial meal at noon, or a little earlier, as is the custom to a great extent on the Continent, a cup of good *café-au-lait*, with a little bread and butter or dry toast,

in the afternoon, be careful not to make a large meal at this hour, as it is almost certain to make them heavy and dull for an hour or two after.

An early dinner of this kind should consist simply of a chop or steak, or a cut or two of some good joint, hot or cold, with a small quantity of bread and vegetables, a little bread and cheese, or butter; or, if preferred, a little light pudding or some cooked fruit.

The widely-spread custom of taking a cup of tea about 5 o'clock is consistent with either of the above methods. For those who have lunched lightly, it affords that little necessary stimulus and support to carry them on to the dinner-time; and for those who have dined early, it favourably influences the process of digestion, and rouses the mental and physical energies for the completion of the day's work.

A substantial dinner at 7 or half-past (it should not be later) is appropriate for those who lunch lightly. It should consist of soup or fish, or both, an entrée, or some joint, poultry or game, according to choice; some cooked fruit or light pudding, biscuit and cheese, and fresh vegetables and salads of the season.

Those who take an early dinner should take a light supper about half-past 8 or 9: a little white fish, or chicken and ham, or other cold meat and salad, with a little bread and cheese or butter.

Considerable variations in the manner, frequency, and time of taking meals appear to be not inconsistent with health and convenience.

There are, as Sir Henry Thompson has pointed out, certainly three different systems extensively practised.

First, there is the Continental system of two meals a day. The *déjeuner à la fourchette*—which corresponds with our lunch or early dinner—is usually taken between 11 a.m. and noon. This is a substantial but not a heavy meal, and frequently consists of some white fish, or cutlets, or a ma[illegible] ome

some bacon, or salt or smoked fish, or an egg. Dinner is the next meal, usually at 1 or half-past. This commonly consists of a joint and plain vegetables, some pudding, and bread and cheese. Soup or fish may be added to this meal on occasions.

Tea follows at 5 or 6. This is not infrequently made a somewhat heavy meal—what is called a "heavy tea"—and is the great defect in this system. It is much too soon after the substantial midday dinner for *another substantial* meal, and these "heavy teas" are responsible for a great deal of the dyspepsia prevalent amongst this class.

There would be no harm in drinking tea at this hour, but the taking of solid food (except with young growing girls and boys) should be postponed to the next meal or *supper* at 8, if the dinner is at 1; at 9 p.m., if the dinner hour is 2 o'clock.

This should consist of a moderate meal of fish or meat, cold or hot, with bread or potatoes.

This system of four meals a day is well adapted to young growing people whose digestions are active and vigorous. They require food more frequently, and in larger quantities, than adults. It is similar also to the German system; but the Germans dine almost universally at 12.30, not later, and their supper is regularly served at 7.30 or 8 p.m.

Thirdly, there is the system, already described, adopted by the professional and upper classes of breakfast, lunch, and late dinner, with 5 o'clock tea. In this system it is the lunch which is the difficulty and danger; it should be, as Sir Henry Thompson observes, sufficient to *support* activity, not so considerable as to impair it. Again let it be said, that solid food should not be taken with the 5 o'clock tea, and it is better not to take either sugar or cream with the tea at this hour. A thin slice of lemon added to the cup of tea, which should be made of China tea of good

a perfectly empty stomach contributes to repose; on the contrary, it frequently is the cause of wakefulness. A certain sense of repletion, a sense of all the wants of the body being completely satisfied, conduces greatly to repose; this is strikingly manifested in the tendency shown by nearly all animals to fall asleep after a full meal. Many persons who of necessity retire to bed late, and who do not dine very late or eat very largely at dinner, find that they sleep much better if they take a breakfastcupful of clear soup with a little toast or the same quantity of arrowroot before going to bed.

It is scarcely necessary to say that the habit of taking food between meals or other than at the stated meal times is most injudicious and hurtful.

A meal should not be commenced immediately after active or violent exercise. The half hour devoted to leisurely dressing for dinner—and after violent exercise half an hour's perfect rest before this—is the best preparation for the principal meal of the day. The stomach requires to have at its disposal the best and freshest energies of the body for its important work—the work, it must not be forgotten, upon which every other energy and function of the body is absolutely and entirely dependent. For the same reason violent exercise after a meal is to be carefully avoided.

The taking of strong tea and strong black coffee after dinner should be avoided by those whose digestions are not vigorous; they act as retarding agencies and tend to prolong the period of digestion, not hasten it; it may, however, be, as Sir W. Roberts has suggested, that the slightly retarding effect they exercise on digestion may not be altogether a disadvantage in the strong and vigorous. A cup of hot water sipped slowly an hour or two after dinner, instead of coffee or tea, or a hot and very weak infusion of the latter, will sometimes be found a material aid to feeble digestion.

minimum amount of food necessary for different ages, stated in grammes :—

Age.	Nitro-genous.	Fat.	Carbo-hydrates.
	grammes.	grammes.	grammes.
Child under 18 months .	20 to 36	30 to 45	60 to 90
„ from 6 to 15 years.	70 „ 80	37 „ 50	250 „ 400
Men (moderate work) .	118	56	500
Women	92	44	400
Old men	100	68	350
„ women . . .	80	50	260

It will be necessary in the first place to consider, and to consider at some length, on account of its *initial* and intrinsic importance, the subject of

Food in infancy and childhood. — The feeding of infancy may be dealt with under three heads—

1st. When the babe is suckled by a healthy mother with a sufficient milk-supply.

2nd. When it is entrusted to a wet nurse.

3rd. When it is "brought up by hand" and has to be fed by means of what are termed "substitutes for mother's milk."

1st. When an infant is suckled by a healthy mother, its food for the first seven or eight months of its life should be entirely restricted to the mother's milk. This is the only food that is perfectly adapted, by its characters and composition, to the digestive capacities of the young infant. For some time after birth the salivary glands are not developed and the pancreatic secretion, for the first three months, has no power of digesting starch, so that the young infant is not provided with any means of digesting farinaceous food, even in small quantities, and none should therefore be given. At birth the digestive organs are in a

month. The greater the quantity secreted, the more casein and sugar and the less fat it contains. The milk of a primipara is richest in solids.

The diet of the mother, no doubt, influences somewhat the composition of the milk, especially as to the amount of fat it may contain. It should be simple, nutritious, ample, and regular. Rich and stimulating foods should be avoided. She may be permitted, for the purpose of increasing the flow of milk, the free use of animal broths, chocolate, milk, gruel, and sometimes a moderate quantity of porter or stout; beer is not suitable.

Oatmeal porridge at breakfast is excellent, and tends to obviate the constipation which often attends this period of relative physical inactivity.

"Fortunate," says an American writer,* "is the babe that, in our day of advanced civilisation and city-living, can draw from the breast of a robust mother an abundant supply of pure, health-giving, tissue-building food." In such a case the child should be nursed *solely* by the mother up to eight months, and after that *partially* to the end of the first year, if possible.

The date of weaning must depend, to some extent, on the health of the mother and the development of the child. If both are doing well, between the tenth and the twelfth month the breast should be gradually withdrawn.

After the seventh or eighth month, when the teeth begin to appear and the salivary glands to be developed, some other food may be introduced, once or twice a day, instead of the breast-milk. The following have all been highly recommended:—

* Dr. Louis Starr, of Philadelphia, to whose admirable article on "The Dietetics of Infancy and Childhood," in Sajous' "Annual of the Universal Medical Sciences," vol. iv. (1888), we are much indebted.

injurious effect on the milk-secretion. Kolesinsky found that the milk becomes thinner and more watery, and contains less proteids and fats, the sugar remaining about the same.

The following table gives the average of observations on five women :—

	Restricted Diet.	Ordinary Diet.
Sp. gravity . . .	1·0312	1·0280
Water	88·34 per cent.	85·80 per cent.
Dry residue . . .	11·66 „	14·20 „
Proteids . . .	1·86 „	2·29 „
Fats	3·41 „	5·17 „
Sugar	5·72 „	5·60 „

Dr. W. J. Thayer, of Brooklyn, New York, offers a valuable suggestion as to the food most appropriate to the expectant mother. "Early in gestation she should begin to eat, at least three times a day, some form of coarse cereal foods, such as oatmeal, Graham, rye, or Indian breads. These articles being made from the *unbolted* products of the grains used, contain a much larger proportion of lime salts than the preparations of fine bolted flour of ordinary employment. The result is that the mother supplies her offspring, first through the umbilical cord, and afterwards through the mammary glands, with a pabulum containing essential elements for the nutrition of a very important set of organs, viz. the teeth." This should be supplied from the commencement of the development of the teeth, *i.e.* about the sixth week of intra-uterine life.

It should also be remembered that certain drugs pass more readily than others from the nurse through her milk to the suckling ; this is the case with iodoform and atropine, and it is said that salicylate of

a strong and peculiar odour, but infants do not seem to object to this. One of the advantages of goat's milk is that the animal yielding the milk can be kept on the premises, and its health and feeding carefully superintended, and it can be trained so that the infant can suck the milk directly from the udder.

Either of these milks may be boiled, and this process removes the strong odour of goat's milk and the laxative property of ass's milk.

The reason why the milk of the ass and even that of the goat will agree with the human infant when cow's milk disagrees, would appear to be owing to their different manner of clotting when they come into contact with the gastric juice.

Cow's milk has a tendency to coagulate in the infant's stomach into large, firm, cheese-like masses, which are apt to cause much gastro-intestinal irritation, whereas ass's and goat's milk form a loose flocculent curd like human milk.

But in the vast majority of instances it is upon cow's milk we must rely as a substitute for mother's milk; it has the enormous advantage of being plentiful and cheap, and its defects can, with a certain amount of care, be easily remedied. A comparative study, therefore, of human and cow's milk is an important duty in connection with infant feeding. It must be borne in mind, as has already been pointed out, that mother's milk varies in composition at different periods of lactation, and in different individuals, so that considerable discrepancies may be discovered in the published analyses. The nitrogenous constituents are the most changeable, and may vary in different specimens from 4·86 to 0·85 per cent., next the fats, and next the salts, the maximum being about three times the minimum. The sugar is the least variable constituent, and maintains a nearly uniform standard of 7 *per cent.*

possible to human milk, and should, like it, clot in fine flakes. If cow's milk is used, its chemical composition and physical properties must be modified in order to make it a fit substitute for mother's milk. It should also be noticed that the albuminates and carbo-hydrates in the infant's diet are in nearly equal proportions, whereas in the diet of adults the proportion of carbo-hydrates to albuminates is as 3 to 1. The proportion of fat is also relatively twice as great as in the standard adult diet. The albuminates and fats are, therefore, largely in excess in the infant's diet as compared with the diet of adults, and this is necessary in order to minister to the very rapid growth which takes place in infancy and childhood, and food has also, on this account, to be taken more frequently. The brain is said to nearly double its weight in seven years. The liver is notably larger in childhood, on account of the greater activity of its metabolic functions.

Much difference of opinion exists as to the suitability of "condensed" milk as a substitute for human milk. It certainly has the advantage of keeping better than ordinary cow's milk, and it is said by some to be more readily digested by young infants, and that they thrive on it. Others assert that this is a delusion, founded on the circumstance that condensed milk is largely diluted with water, and cow's milk not sufficiently; that the infant appears to thrive because condensed milk contains a large proportion of added sugar, which forms fat and makes large babies, and also counteracts the tendency to constipation, but that it does not contain enough nutrient constituents to supply the wants of a growing infant. In the following table A. Y. Meigs has compared the composition of condensed milk diluted in the proportion usual for the first week or so of infant life, with some average specimens of human and cow's milk :—

children brought up on it from birth; it is undoubtedly convenient; it does not readily turn sour, and it may often, they think, be substituted with good effect for fresh cow's milk when the latter disagrees and causes vomiting, or at those times when cows are being fed on turnips or other watery food, or during hot weather, when milk is apt to turn sour.

The deficiency in casein may be compensated for by the addition of a little white of egg or raw meat juice, half a teaspoonful of either to every other meal, and the addition of a little cream will supply the deficiency in fat.

We have received strong testimony in support of this favourable view of the use of condensed milk as a substitute for breast-milk, especially when the "*unsweetened*" kinds are used, such as Loeflund's.

Farinaceous foods are never admissible before the fourth month, and rarely advisable until after the seventh. It must not be forgotten that they differ widely in composition from human milk. In arrowroot, which is one of the most digestible, the proportion of albuminates to carbo-hydrates is as 1 to 20; whereas in human milk it is as 1 to 5. Moreover, the starch has to be converted into sugar before it can be absorbed, and the digestive secretions which effect this conversion are not fully established until the fourth month.

The so-called "infants' foods"* usually contain some malted farinaceous substance, and they are of value as additions to, not as substitutes for, milk. Their nutrient value has not been perfectly determined; but they are especially useful as "mechanical attenuants," and as such tend to prevent the coagulation of cow's milk into firm, indigestible curd. They

* "Liebig's food for infants is composed of equal parts of wheaten flour and malt flour mixed with a little potassium carbonate, and cooked with ten parts of milk. The wheat and malt flour are usually cooked and sold in powder ready to be boiled with the milk." (*Parkes.*)

The following is considered an excellent rule for the earlier weeks of infant feeding, viz. one hundredth of the initial body-weight should be taken as the starting quantity of food for each meal, and to this should be added 1 gramme (fifteen minims) for each day of life. For instance, if the initial weight is 3000 grammes (6 lb.), then 30 grammes (about 1 oz.) should be given at a meal; at fifteen days it would have increased to 30 + 15 grammes or 45 grammes (about 1½ oz.), and at eighty days to 30 + 30 or 60 grammes (about 2 oz.).

Ashby and Wright estimate 5 oz. of good cow's milk (of course, properly diluted and prepared) to be sufficient daily for the first two or three weeks. Starr calculates for the first four weeks an allowance of 12½ to 16 oz. of food daily; 24 oz. for the 2nd and 3rd month; 2 to 2½ or 3 pints from the 3rd to the 12th month. Ashby and Wright consider 1½ to 2 pints daily sufficient between six and twelve months.

After this period it is advisable rather to increase the strength of the food than the quantity.

Dr. Louis Starr gives the following table as a guide:—

GENERAL RULES FOR FEEDING.

Age.	Intervals of Feeding.	Average Amount at each Feeding.	Average Amount in 24 Hours.
1st week	2 hours.	1 oz.	10 oz.
1st to 6th weeks . .	2½ ,,	1½ to 2 ,,	12 to 16 ,,
6th to 12th weeks, and possibly to 5th or 6th months . . .	3 ,,	3 to 4 ,,	18 to 24 ,,
At 6 months . . .	3 ,,	6 ,,	36 ,,
At 10 months . . .	3 ,,	8 ,,	40 ,,

boiling in a small tin pan placed over a spirit or gas lamp. During the heating a further quantity of casein, technically called "fleetings," separates, and must be removed by straining through clean muslin. Now dissolve 110 grains of powdered sugar of milk in the hot whey, and mix it with $\frac{2}{3}$ of a pint of new milk to which the cream from the other fluid has already been added as already described. The artificial milk should be used within twelve hours of its preparation.

In order to prevent the firm clotting to which cow's milk is prone, some alkaline solution may be added, or some prefer to use a small quantity of a mucilaginous or other thickening substance, such as barley-water, a solution of gelatin, or one of the prepared foods, which act mechanically in obviating the formation of firm clots.

When lime-water* is used for this purpose, it acts by partly neutralising the acid of the gastric juice, so that the casein is coagulated gradually in small masses, or passes on into the small intestine where the secretions are alkaline. It must be in the proportion of 1 to 2 of the milk mixture.

Or a few grains of bicarbonate of soda may be used, or an equivalent quantity of the saccharated solution of lime. Thickening substances or attenuants act purely mechanically by, as it were, getting between the particles of casein during coagulation, and so preventing their running together and forming large compact masses.

The best for this purpose is barley-water or "barley-jelly." It may be used in the same proportions as water.

* Lime-water is easily made at home for nursery use by taking a piece of unslaked lime the size of a walnut, and putting it into two quarts of filtered water in an earthen vessel, and stirring it up thoroughly; allow it to settle, and pour off the clear solution as required for use, replacing with water and stirring up as consumed.

During the same period Dr. Angel Money* recommends ½ an oz. of thin barley-water with ½ an oz. of cow's milk and 15 grains of milk-sugar, to be given every two hours, night and day.

DIET FROM THE 2ND TO THE 6TH WEEK.

For each feeding.

Milk (Cow's)	½ fluid oz.
Cream	¼ " "
Milk-sugar	15 grains.
Water	1 fluid oz.

To be given every 2 hours from 5 a.m. to 11 p.m. = 17 oz. per diem.

DIET FROM THE 6TH WEEK TO THE END OF THE 2ND MONTH.

For each feeding.

Milk (Cow's)	1¼ fluid oz.
Cream	½ " "
Sugar of Milk	30 grains.
Water	1¼ fluid oz.

To be given every 2 hours = 30 oz. per diem.

Dr. Angel Money's diet is cow's milk, 9 drams; barley water, ¾ oz.; cream, 2 drams; milk-sugar, 30 grains; and water, 3 drams; every 2½ hours.

DIET FROM THE BEGINNING OF THE 3RD MONTH TO THE 6TH MONTH.

For each feeding.

Milk (Cow's)	2½ oz.
Cream	½ "
Sugar of Milk	60 grains.
Water	1 oz.

To be given every 2½ hours = 32 oz. per diem.

* "Treatment of Diseases of Children."

washed pearl barley into a pint and a half of water, and slowly boiling down to a pint; strain, and let the liquid settle into a jelly. Two teaspoonfuls of this, dissolved in 8 oz. of warmed and sweetened milk, are enough for a single feeding, and such a meal may be allowed twice a day.

DIET FOR THE 10TH AND 11TH MONTHS.

1st meal,	7	a.m.—Milk	8½ fluid oz.
		Cream	½ ,,
		Mellin's Food or Barley Jelly	½ ,,
		Water (only when Mellin's Food is used) .	1 ,,
2nd ,,	10.30	a.m.—8 oz. of warm milk.	
3rd ,,	2	p.m.—The yolk of an egg lightly boiled, with stale bread-crumbs.	
4th ,,	6	p.m.—Same as 1st.	
5th ,,	10	p.m.—Same as 2nd.	

On alternate days the third meal may consist of 6 oz. of beef-tea, with a few stale bread-crumbs. Mutton, chicken, or veal broth may be occasionally used instead of beef-tea. Infant's beef-tea is not made so strong as that for adults. (½ lb. of beef to a pint.)

To remedy a tendency to vomit the milk in firm clots, each bottle at the age of six weeks may consist of either

Milk	1¼ oz.
Cream	½ ,,
Sugar of Milk	30 grains.
Lime Water	1¼ oz.

or

Milk	1¼ oz.
Cream	½ ,,
Sugar of Milk	30 grains.
Barley Water	1½ oz.

Mellin's Food	60 grains.
Hot Water	3 oz.

for each feeding—given every 2 hours at the age of 6 weeks; or

Veal or Chicken Broth ($\frac{1}{2}$ lb. of meat to pint) .	$1\frac{1}{2}$ oz.
Barley Water or Jelly	$1\frac{1}{2}$,,

or

Whey	$1\frac{1}{2}$ oz.
Barley Water	$1\frac{1}{2}$,,
Sugar of Milk	$\frac{1}{2}$,,

A teaspoonful of raw beef-juice every two hours will often be retained when all other food is rejected. As soon as milk food can be resumed, it of course should be.

Ashby and Wright recommend a trial of Biedert's cream mixture for the first few weeks when the child cannot digest cow's milk. It is made by mixing 4 oz. of cream with 12 oz. of warm water, and adding $\frac{1}{2}$ oz. of milk-sugar. It contains 1 per cent. of casein, 2·5 per cent. of fat, and 3·8 per cent. of sugar. As the child grows older, milk is added till it reaches equal parts. Most infants digest cream exceedingly well. Meigs' modification of this is as follows:—Make a solution of milk-sugar ($2\frac{1}{4}$ oz.) in water (1 pint); put it in a cool place. For each feeding mix 1 oz. of cream, $\frac{1}{2}$ oz. of cow's milk, 1 oz. of lime-water, and $1\frac{1}{2}$ oz. of the solution of milk-sugar. The same authors strongly commend Savory and Moore's peptonised milk as very palatable and easily prepared by mixing with warm water. Much of the casein in it has been converted into peptone. It keeps well for a few days, being preserved by the addition of cane-sugar, and is concentrated to $\frac{1}{6}$ or $\frac{1}{7}$ of its bulk of milk. We can also testify to the value of this preparation. Whey is a very useful food, when milk disagrees, and is not so much used as it

As an Alternative Diet.

1st meal, 7 a.m.—The yolk of an egg lightly boiled, with bread-crumbs. A teacupful of new milk.
2nd „ 10 a.m.—A teacupful of milk, with a thin slice of buttered bread.
3rd „ 2 p.m.—A mashed boiled potato, moistened with 4 tablespoonfuls of beef-tea. Two good tablespoonfuls of junket.
4th „ 6 p.m.—A breakfastcupful of new milk, with a slice of bread broken up and soaked in it.
5th „ 10 p.m.—Same as 2nd.

The fifth meal is not always necessary, and sleep should not be disturbed for it. A cup of warm milk should, however, be available during the night if required.

Diet from 18 Months to 2½ Years.

1st meal, 7 a.m.—A breakfastcupful of new milk, the yolk of an egg lightly boiled, 2 thin slices of bread and butter.
2nd „ 11 a.m.—A teacupful of milk with a soda biscuit.
3rd „ 2 p.m.—A breakfastcupful of beef-tea, mutton or chicken broth; a thin slice of stale bread; a saucer of rice and milk pudding.
4th „ 6.30 p.m.—A breakfastcupful of milk with bread and butter.

As an Alternative Diet.

1st meal, 7 a.m.—Two tablespoonfuls of thoroughly cooked oatmeal or wheaten grits, with sugar and cream; a teacupful of new milk.
2nd „ 11 a.m.—A teacupful of milk, with a slice of bread and butter.
3rd „ 2 p.m.—One tablespoonful of underdone mutton, pounded to a paste; bread and butter, or mashed baked potato, moistened with good plain dish gravy; a saucer of junket.
4th „ 6.30 p.m.—A breakfastcupful of milk, a slice of soft milk toast, or a slice or two of bread and butter.

following lists of suitable dishes from which to select may serve as a convenient guide:—

BREAKFAST.

Daily.	*One dish only each day.*
Milk.	Fresh fish.
Porridge and cream.	Eggs, lightly cooked.
Bread and butter.	Chicken hash.
	Stewed kidney.
	„ liver.

Thoroughly ripe sound fruit may be allowed with this meal in small or moderate quantity.

DINNER.

Daily.	*Two dishes each day.*
Clear soup.	Potatoes, baked and mashed.
Meat, roasted or broiled, and cut into small pieces.	Spinach.
Bread and butter.	Stewed celery.
	Cauliflowers.
	Hominy.
	Macaroni, plain.
	Peas.
	French beans.

Junket, rice and milk, or other light pudding.

SUPPER.

Daily.

Milk.
Milk toast, or bread and butter.
Stewed fruit.

As to quantity, if a child eats slowly and masticates thoroughly he may generally be trusted to satisfy his appetite at each meal. Fried food and highly-seasoned dishes should be avoided. Salt, but no other condiment, should be allowed, and pure water should be the only drink. Some feeble and thin children may, however, be allowed, from time to time, a little sound beer or porter.

Recently, in America especially, *Kefir*, the product

In kefir we have the soluble forms of albumen due to the action of the ferment, and consequently the light, flocculent coagulation. "Theoretically, then, we should have in *kefir* one of the very best foods for infants, if lactic acid, carbonic acid gas, and alcohol are not counter-indications. Lactic acid is found in the stomach in the normal digestion of the sugar of milk, and its presence can but assist in the digestion of the casein. Carbonic acid gas rather increases the secretion of the glands, and alcohol in a dilute solution is a tonic, and stimulates digestion and nutrition."

Children do not like it at first, but the addition of a little sugar soon overcomes the distaste, and they prefer it to cow's milk. The sugar may be omitted after a day or so. A slight diarrhœa usually follows its first use, but quickly subsides.

Its effects are said to be as follows:—1. Increase in quantity of urine in proportion to fluid consumed. 2. Specific gravity of urine diminishes. 3. Nitrogenous changes are checked. 4. Digestion is strengthened and stimulated in even the worst forms of indigestion, and the nutrition of the body improved. 5. Gain in body-weight is rapid and enormous. 6. The number of red blood-corpuscles increases.

Rules for administration:—

1. If the infant be less than a month old, it should be given diluted ⅓ with water; this proportion may be gradually lessened till at six weeks it is given pure.

2. It should be fed slowly from a simple, easily-cleansed nursing-bottle.

3. When used it should constitute the only food, up to a year old, when crackers, toast, etc., may be given with it; and one meal a day may consist of oatmeal-mash or other farinaceous food.

4. For young infants it is best in the fresh state. As the child grows older, fully-fermented kefir may be used.

provide a fairly nutritious, but unstimulating, supper at 8 p.m. Porridge made with milk would be excellent; or tapioca, or rice pudding, with marmalade, or, in winter, some good soup with bread or other farinaceous substance, or any other light, but nutritious, food. The need for this seems to us obvious. We are dealing with a period of rapid growth when digestion and assimilation are active; and it is, surely, undesirable that a fast extending from a light meal at 5 or 6 p.m., to 7 a.m., and sometimes 8 a.m., the following day—a fast of thirteen or fourteen hours—should be inflicted on a rapidly-growing boy or girl.

This prolonged fast has appeared to us to be attended with, and often to be the cause of, serious loss of health, especially in girls' schools. For it must be remembered that girls between twelve and sixteen years of age often develop with amazing rapidity, and require ample and frequent supplies of food. We are fully convinced that the anæmia and constipation so commonly observed amongst young girls at the approach of puberty are frequently due to insufficient supplies of food, or to food of unsuitable quality. The constipation is probably due to a deficiency in fresh vegetables, and the want of a sufficiently bulky and stimulating diet; while the anæmia is, in many instances, the direct result of an imperfect supply of animal flesh—that is, of food which contains the maximum of iron and the material necessary for red corpuscle-making.

As to different articles of diet, we can coincide with most of Dr. Dukes's recommendations.

The bread should be wholemeal bread. This is no doubt the best bread for growing children and young people. There is little risk of their not being able to digest it, and it is certainly richer in the mineral substances they especially require than fine white

week in winter; or beet-root, pickles and salad should be more freely provided. This is of much importance, as eczema is prone to appear amongst boys at school who are kept on a too exclusively animal diet.

Pastry should be provided frequently at dinner, and visits to the pastrycook's *before* dinner should be strictly prohibited. "Hampers" are objectionable and a frequent cause of illness.

Beer and all alcoholic drinks are objectionable, as exciting the passions; milk is to be preferred.

We have, however, seen thin, delicate boys with small appetites greatly benefited by a glass of light, sound beer with dinner.

The greater relative defects in the diet of girls' schools was animadverted upon some years ago by the late Dr. Combe. He pointed out then that the system of diet "in female boarding-schools is often insufficient for due sustenance and growth, and, consequently, the natural expression of impaired health, if not actual disease, is a marked feature in the aspect of most of the pupils. So defective indeed is the common school management in this and other respects that we have the best authority for considering it as a rare exception for a girl to return home in full health after spending two or three years at an English boarding-school." Germain Sée also insists upon the urgent necessity of paying more attention to the feeding of young girls at school. We should understand, he says, "the absolute necessity of animal food, of abundance of meat plainly cooked, which contains all the principles of the blood, fibrin, hæmoglobin, and iron itself, in sufficient amount to enable us to dispense with ferruginous drugs. Such an albuminous diet, together with nitrogenous farinaceous foods and fish, and an abundant supply of oxygen and an open-air life, supplies all that is required." He mentions a provincial college for young girls (at Abbeville) which

deficiency. This allowance of meat is what is given in one of the model *lycées*. Professor G. Sée states that in many others the feeding is far more defective.

Food in adult life.—The considerations which should guide us in determining the food appropriate to adult life have already been incidentally dwelt upon. In the first place we have to consider the circumstance that growth and development are for the most part over; but it must also be remembered that although, in young adults, the framework or skeleton of the body has ceased to grow, it is by no means certain that other organs of the body have, in all cases, reached their full development; and it is a very well-known fact that the body, especially in the male, commonly continues to increase in weight for some years after adult life has been attained. It is prudent, in many instances, to regard the young *man* as not having quite completed his physical development until he has reached his twenty-third or twenty-fifth year. Complete organic development is much earlier arrived at in the human female.

When, however, growth and development are completely over, it is clear there cannot be precisely the same food-requirements as exist when growth and development are in active progress. But throughout healthy and active adult life, although food is no longer needed for the purposes of growth, it is needed in due and sufficient amount to meet all the requirements attending the daily work of the organism, to supply the force developed in the various forms of energy which the human body normally displays, and to keep in sound repair all the various organs employed.

The food appropriate to adult life must thus depend very greatly on the conditions and circumstances which affect each individual—on sex, on physical

different persons, an undesirable balance remains against the feeder, and in young people is mostly rectified by a 'bilious attack,' through the agency of which, a few hours of vomiting and misery square the account. Then the same process of over-feeding recommences with renewed appetite and sensations of invigorated digestion, until in two or three, or five or six weeks, according to the ratio existing between the amount of food ingested and the habit of expending or eliminating it from the body, the recurring attack appears and again clears the system, and so on during several years of life. If the individual takes abundant exercise and expends much energy in the business of life, a large quantity of food can be properly disposed of. Such a person enjoys the pleasure of satisfying a healthy appetite, and doing so with ordinary prudence, not only takes no harm, but consolidates the frame, and enables it to resist those manifold unseen sources of evil which are prone to affect injuriously the feeble. On the other hand, if he is inactive, takes little exercise, spends most of his time in close air and in a warm temperature, shaping his diet, nevertheless, on the liberal scheme just described, the balance of unexpended nutriment soon tells more or less heavily against him, and must be thrown off in some form or other, more or less disagreeable. . . .

"After the first half or so of life has passed away, instead of such periodical attacks of sickness, the unemployed material may be relegated in the form of fat to be stored on the external surface of the body, or be packed among the internal organs, and thus he or she may become corpulent and heavy, if a facility for converting appropriate material into fat is consistent with the constitution of the individual; for some constitutions appear to be without the power of storing fat, however rich the diet or inactive their

approach to equality between the supply of nutriment to the body and the expenditure produced by the activity of the latter; and, secondly, ignorance of the method of attaining this object in practice, which give rise to various forms of disease calculated to embitter and shorten life after the period of prime has passed."

Many methods of eliminating this excess of food are practised. The various forms of muscular activity involved in out-of-door games and exercises, so long as they can be adopted with safety, are as valuable as they are popular; but their pursuit is often unwisely protracted to a period of life when they are no longer safe or useful, and it is then that the eliminative effects of the Turkish bath or of an occasional course of purgative waters find their appropriate application.

Of late years a habit of drinking milk as a beverage at meals has been largely adopted, without, apparently, reflecting that milk is a highly nutritious *fluid food* which has the property of becoming *solid* when it meets the acid gastric juice; and a large excess of solid food may thus inadvertently be taken. "There are even some persons who must wash down their ample slices of roast beef with draughts of new milk!—an unwisely-devised combination even for those of active habit, but for men and women whose lives are little occupied by exercise it is one of the greatest dietary blunders which can be perpetrated. It is altogether superfluous and mostly mischievous as a drink for those who have reached adult age and can digest solid food."

The quantity of food, then, required in adult life will be conditional, to a great extent, on the habits of the individual with regard to physical activity.

"But there is a certain qualification, apparent but not real, of the principle thus enunciated. It is

devoted to the process. When properly carried out, it is attended with a loss of fat and water and an increase both in bulk and firmness of the muscles; and this is accompanied by a feeling of lightness and freedom, and "fitness" for exertion. The skin especially improves in appearance, and should become "clear, smooth, fresh-coloured and elastic." It used formerly to be the custom, now abandoned as injurious, to begin a course of training by an emetic and repeated saline purges. The transition from the usual diet should not be too sudden, but duly graduated, and the food selected should be palatable and digestible.

Lean meat always enters largely into the diet of training, for it has been established that a meat diet leads to the removal of superfluous water and fat, lessens weight, and imparts firmness and endurance to the muscles. Beef and mutton, roast or grilled and "underdone," are usually preferred. Toast or stale bread, and a moderate quantity of potatoes and green vegetables, especially watercresses, are allowed. All entrées, all puddings and pastry are strictly forbidden, as are all sauces, pickles and condiments; the object being to preserve or develop a simple, natural appetite, and not provide food which may provoke to excess.

To meet the loss of water from the body involved in active exertions a certain amount of fluid must be taken, but it is usual to limit this with some care, and only sufficient to allay thirst should be taken, and that should be slowly sipped; any excess of drink being injurious. Barley-water, toast-and-water, tea, coffee and cocoa are permitted, as well as a little beer or light wine. *No* spirits,

Only three meals a day should be taken: one at 8.30 or 9 a.m.; the second, about 1 or 2 p.m; and a supper between 8 and 9 p.m. After the period of training is over the transition to the ordinary habits of feeding should again be easy and gradual.

Adults whose lives are necessarily and chiefly devoted to *intellectual* or other sedentary occupations should not attempt to consume the same amount of food as those whose duties or pursuits involve much physical activity in the open air. The kinds of food they take may also frequently be modified with advantage. The substitution of fish, to some extent, for butcher's meat, has much to recommend it in these individuals. It is not so rich in nitrogenous substances as butcher's meat, and does not throw so much work on the eliminating functions; and the lighter kinds are much easier of digestion. There is, however, no foundation for the popular view that fish contains elements which adapt it in a special manner to be a "brain-food" or to sustain and promote intellectual labour. "The value of fish to the brain-worker is due simply to the fact that it contains, in smaller proportions than meat, those materials which, taken abundantly, demand much physical labour for their complete consumption, and which, without this, produce an unhealthy condition of body, more or less incompatible with the easy and active exercise of the functions of the brain." (*Sir H. Thompson.*)

Brain-workers should live much on light food not demanding much effort of the stomach to digest, and they should remember that the digestion of heavy meals involves also a greater expenditure of nerve-force. Besides fish, eggs, milk, light porous *well-made* bread, fresh vegetables and fruit should form their chief sustenance. They should take only a small amount of butcher's meat, and that especially on those occasions when they are able to take more physical exercise. Some animal fat is, however, useful, such as fresh butter or cream, or a rasher or two of fat bacon at breakfast. It is a remarkable fact that whereas the muscles contain only three per cent. of fat the brain contains eight per cent., and the nerves

quick digestions require food more frequently. Long fasts are, as a rule, ill-borne by feeble persons who cannot eat largely at their meals, and such persons are often better for taking a small quantity of food between their late dinner and breakfast, which usually involves a fast of twelve or more hours. A little light food on going to bed, or, if they wake, as they are prone to do, in the night, is advisable. This may be simply a cup of clear soup, or beef-tea, or gruel, milk, or arrowroot.

It is to be noted also that *women* require less food than men, as their bodies are usually smaller, and they more commonly lead inactive, sedentary lives. They, however, pass through critical periods, which may require special care; *e.g.* after repeated profuse hæmorrhage at the menstrual periods, they may require a diet rich in albuminates to repair the losses caused thereby. It has already been pointed out that especial provision should be made in the dietary for the special calls upon the system which pregnancy and lactation involve.

Food in advanced age. — With advancing years the functional activity of the bodily organs diminishes, the capacity for physical exertion is considerably weakened, and the mental powers usually begin to flag; the functional activity in the digestive organs partakes in this general decline, so that while there is less need for food on account of lowered physical and mental activities, there is also less power of digesting and assimilating food on account of the slowly progressing degenerative changes in the secreting glands and the consequent diminished digestive and absorbent power in the alimentary canal. The circulation through the abdominal organs also tends to become languid, so that absorption is thereby delayed, and may be further hindered by degenerative

while a good supply of food is essential during the period of growth and active middle life, a diminished supply is desirable in relation to health and prolongation of life during declining years, when physical exertion is small, and the digestive faculty sometimes becomes less powerful also. . . . The system of 'supporting' aged persons, as it is termed, with increased quantities of food and stimulants, is an error of cardinal importance, and without doubt tends to shorten or to embitter life. . . . As age increases the ability to eliminate food unnecessarily consumed notably diminishes. . . . The elderly man who desires to preserve fair health and to attain to longevity should gradually diminish his use of strong nitrogenous and much fatty food." *

In Professor Humphry's report on "Centenarians," published in the reports of the Collective Investigation Committee of the British Medical Association (vol. iii., 1887), it appears that their habits in the matter of eating and drinking tended, as a rule, to great moderation in both. The large majority were small or moderate eaters. Of animal food the majority took but little. Of thirty-seven, three took none, four took *very* little, twenty took little, ten took a moderate amount, and one only took *much*. The exact quantity is mentioned in nine instances: one took 12 oz., one 6, one 5, and six 4 oz. daily. In the use of alcoholic drinks we also find evidence of great moderation. Fifteen were either all their lives or in their old age or youth total abstainers; twenty-two took but little, two very little, ten a moderate amount of alcohol, and some who had taken a little alcohol formerly were taking none in their old age. It is remarkable how numerous, in the published records of centenarians, are the references to the great sobriety, temperance, and "abstemious" habits of the

* "Food and Feeding."

and meals consisting of a small or moderate amount of easily-digested food should succeed one another at not too long intervals.

Of the animal foods best suited for this time of life, the following may be mentioned. When the organs of mastication are altogether inefficient, these foods should be minced or pounded into a paste, or otherwise finely subdivided :—

Young and tender chicken and game, and other tender meats.
Potted chicken, game, and other meats. Sweetbread.
White fish, as soles, whiting, smelts, flounders, etc. Best when boiled.
Bacon, grilled; eggs lightly cooked, or beaten up with milk, etc.
Nutritious soups, such as chicken *purées*, or fish *purées*, beef-tea, mutton, and chicken broths.
Milk in all forms when easily digested.
Beef-tea and milk supply the needed mineral substances, and the former is an excellent stimulant.
The addition to milk of an equal quantity of Vichy water, warm, or of warm water, will often help to make it agree.

Of vegetable foods the following are all suitable :—

Bread-and-milk made with the crumb of stale bread, and without any lumps.
Porridge and oatmeal gruel.
Puddings of ground rice, tapioca, arrowroot, sago, macaroni, with milk or eggs, and flavoured with some warm spices, or served with fruit-juice or jelly; bread and butter, the bread at least a day old; rusks, for soaking in tea or milk and water.
Artificial foods, consisting of predigested starches; the digestive ferments are scantily provided by the digestive organs at this age, and soluble carbo-hydrates are valuable for maintaining the body-heat.
All farinaceous foods should be submitted to a high temperature for some time, so as to render the starch granules more easy of digestion.
Vegetable purées of all kinds may be taken in moderation, *e.g.* potatoes, carrots, spinach, and other succulent vegetables.
It is important that the use of potatoes and fresh vegetables

CHAPTER XII.

THE RELATIVE ADVANTAGES OF ANIMAL AND VEGETABLE FOODS — VEGETARIANISM (BENEKE'S DIET FOR CARCINOMA).

All the alimentary substances needed for the nutrition and sustenance of the body can be obtained either from the vegetable or the animal kingdom. Albuminates, carbo-hydrates, fats, and mineral substances, identical in nature and composition with those which are found in the animal body, are to be derived also, as we have seen, from vegetable products.

There is, however, a considerable difference in their assimilability in the alimentary canal. Albuminates (and fats also) derived from animal sources —as in flesh, eggs, milk, etc.—are almost entirely and rapidly absorbed in the stomach and intestine; whereas the albumen of vegetable substances is generally found in association with relatively large quantities of starch, and these are enclosed in a network of cellulose which is excessively resistant to the action of the digestive juices; and it has been calculated that while only 3 per cent. of the albumen of animal food escapes digestion and is lost in the evacuations, as much as 17 per cent. of the albumen of vegetable foods is thus wasted. If, then, a man were to consume only as much vegetable food as would afford the actual amount of albumen, salts, and starches necessary to cover the daily losses of the body, inasmuch as a large proportion would pass out of the body unutilised, because undigested, the portion appropriated would not suffice for the sustenance of the body. It is necessary to consume a

bone; and it is a matter of common knowledge that herbivorous animals show a far greater tendency to the deposition of fat than flesh-eaters. We especially select herbivorous animals for purposes of fattening; and even carnivorous animals, if restricted, to some extent, to vegetable foods, become fatter.

The consumption of food rich in nitrogenous constituents appears also to promote oxidation within the body, and to be attended by a greater absorption of oxygen from the respiratory organs; and it is probably owing to its determining an increased oxidation of the fat deposited in the tissues that an exclusive diet of animal flesh has been found to act as a remedy for obesity.

The urinary excretion is increased in quantity by animal food, and the amount of urea, as is well known, is also increased, together with the phosphates and sulphates. An animal diet tends further to increase the acidity of the urine: a vegetable diet to render it alkaline. The urine of the herbivora is acid during fasting and alkaline after feeding. The urine of the calf while sucking is acid, but becomes alkaline as soon as it begins to feed on grass. Animal food is certainly more stimulating than vegetable food, and appears to satisfy and allay the cravings of hunger more completely and for a longer period. The reason of this probably is that animal albuminates are digested, and to a great extent absorbed, in the stomach; they remain longer in that organ than vegetable foods (which are almost entirely digested in the small intestine), and enter more quickly into the general circulation, so that their sustaining influence is more quickly felt.

It is said with regard to animals that they are made more ferocious by animal food, and that the herbivora are less combative than the carnivora; and Liebig has related of a bear kept in the Anatomical

others that they must expect to encounter a rational opposition.

Nor is it safe to argue that a particular mode of diet is good for the race simply because it appears to answer the wants of certain individuals. As Sir W. Roberts has justly observed: "The effects of a vegetarian diet would only be gradually developed, and would, probably, not be fully impressed on the bodily and mental qualities of the race until after such habits had been continued through two or three successive generations," and he mentions having encountered at Salford, "where, some years ago, there existed a flourishing colony of vegetarians, a tradition to the effect that though vegetarianism might suit the parents, it was bad for the children;" and he testifies to having seen "some striking examples in that borough which appeared to indicate that this tradition was well founded."

But there exists also abundance of evidence that a purely vegetable diet is not the most appropriate for the production of either physical or intellectual effort.

Jules Béclard has recorded in his well-known text-book on Physiology that "the workmen employed at the forges of Tarn were for a long period fed with vegetable substances. It was then found that all the workmen lost, on an average, fifteen days' work a year on account of exhaustion or illness. In 1883, Mons. Talabot, deputy of La Haute Vienne, took charge of the forges. Meat was then made an important part of the diet. The health of the men afterwards improved so greatly that they did not lose more, on an average, than three days' labour a year. Animal food produced a gain on each man of twelve days' work a year."

It has also been stated that the Italian labourers from Lombardy, with their largely vegetable dietary,

If we look to the history of the human race, we see that man has been guided in the selection of his food by the circumstances and conditions with which he has been surrounded. His physical organisation seems peculiarly adapted to enable him to accommodate himself to such food supplies as he may be able to procure, without regard to whether they are derived from the animal or vegetable kingdom.

In Arctic regions, where no vegetable can be procured, man lives entirely on flesh and fat, and in hot countries, where fruits and nutritious vegetables abound and are readily procurable, he consumes these largely. But it is a common error to suppose that the natives of all hot climates live to a great extent, or almost exclusively, on vegetable food; wherever animal food can be readily procured, it is, as a rule, taken as food. Of the Pampas Indians, who live in a "climate which is burning hot in summer," it is recorded that "they have neither bread, fruit, nor vegetables, but subsist entirely on the flesh of their mares;" and as to the effect of such a diet, Sir Francis Head testifies, "after I had been riding for three or four months and had lived on beef and water, I found myself in a condition which I can only describe by saying that I felt no exertion could kill me"!

The Chinese eat fish and pork with their rice, the Japanese eat fowls in great abundance, and the flesh of whales is a very common food in several places amongst the poorer classes.

The Arabs who inhabit the Nubian desert subsist entirely on animal food; the Abyssinians eat largely of raw flesh. As to the food of the East African, it is stated by Burton that "the Arabs assert that in these latitudes vegetables cause heartburn and acidity, and that animal food is the most digestible. A man who can afford it almost confines himself to flesh, and

great advance in the domestic economy of the poor and labouring classes in England—if they could be taught to turn to better account than they do the abundant resources of nutritious and agreeable food to be found in some of the now greatly neglected vegetable products at their disposal. The absolute want of knowledge amongst the women of this class of the proper methods of cooking and preparing vegetable food of certain kinds, so as to make them into appetising, agreeable, nutritious, and digestible dishes, is undoubtedly the chief cause of their wasteful neglect of these foods—a wastefulness almost *peculiar* to the labouring classes of England, and traceable probably to their greater command of supplies of animal food. This waste is especially apparent in their treatment of green vegetables, vast quantities of which are thrown away—namely, all the outside leaves of lettuces, cabbages, etc.—which in another country would be cleaned and trimmed and entirely utilised as wholesome food.

Sir Henry Thompson especially calls attention to the value of the haricot bean, as one of the best of the pulses for the labouring classes, and exceedingly economical, as they can be obtained at a cost of 2d. per pound.

His directions for cooking the beans are as follows :—

" Soak, say, a quart of dry haricots in cold water for about twelve hours, after which place them in a saucepan, with two quarts of cold water and a little salt, on the fire ; when boiling remove to the corner, and simmer slowly until the beans are tender, the time required being about two or three hours. (If the water is hard, a little soda should be added to soften it.) This quantity will fill a large dish, and may be eaten with salt and pepper. It will be greatly improved at small cost by the addition of a

a superfluous quantity—very little nitrogen, and scarcely any fat; hence he obtains, when he can, milk, lard, or bacon, or a herring, to supply the deficiency. The Highlander, living mainly on oatmeal, requires a much smaller weight, since his grain contains not only starch, but much nitrogen and a fair amount of fat, although not quite sufficient for his purpose, which is usually supplied by adding milk or a little bacon to his diet. On the other hand, the man who lives chiefly or largely on flesh and eggs, as well as bread, obtains precisely the same principles, but served in a concentrated form, and a weight of 2 or 3 lb. of such food is a full equivalent to the Irishman's 10 or 11 lb. of potatoes and extras. The meat-eater's digestion is taxed with a far less quantity of solid, but that very concentration in regard of quality entails in some stomachs an expenditure of force in digestion equal to that required by the vegetable-eater to assimilate his much larger portions. And it must be admitted, as a fact beyond question, that some persons are stronger and more healthy who live chiefly, or altogether, on vegetables; while there are many others for whom a proportion of animal food appears to be desirable, if not necessary."

"Englishmen consume too much animal food, particularly the flesh of cattle. For all who are occupied with severe and continuous mechanical labour, a mixed diet, of which cereals and legumes form a large portion, and fish, a little fat meat, bacon, or lard, eggs and milk form a moderate, but constant proportion, is more nutritious and wholesome than almost entirely animal food. For those whose labour is chiefly mental, and whose muscular exercise is inconsiderable, still less of concentrated nitrogenous food is desirable." *

* "Food and Feeding," pp. 21-27.

Beneke maintains that by means of this diet he reduces the proportion of nitrogenous to non-nitrogenous aliment from 1 to 5, which is the common one, to 1 to 8 or 9. Moreover, there will be a distinct reduction of phosphates, for the necessary salts of potash will be taken chiefly in combination with the vegetable acids, malic and tartaric; the urine will consequently have a less acid reaction. He restricts the consumption of cereals and pulses as much as possible.

It has been questioned whether a person could subsist on a diet so defective in albumen and phosphates. Beneke replies that he has proved, by practical experience, that it is possible, and that persons so treated manifest no loss of strength or disturbance of functions.

It must be noted, however, that in this diet for carcinomatous patients, the predominance of vegetable foods is simply designed in order to supply the least possible amount of albumen and phosphoric acid, and is not founded on any strict vegetarian principles as to the *source* of the foods, whether from the *animal* or *vegetable* kingdom; regard is only had to the chemical composition of the food.

The value of a diet in which as little albumen and salts of phosphoric acid as possible is introduced into the system in the treatment of cancer is founded by Beneke on the following considerations. The protoplasm of the cells consists essentially and in general of water, albumen, cholesterin and lecithin, with smaller quantities of neutral fats and fatty acids, phosphates of potash and lime, and chlorides of the alkalies; that these constituents exist in different cells in relatively different quantitative proportion. Beneke believes the cells of carcinoma are relatively rich in cholesterin and in lecithin, and since cholesterin is a product of albuminates, which are, again, rich in

alkaline and earthy phosphates, he concludes that the growth of the tumours in question may be checked by the use of a diet which, while just answering the needs of the body in other respects, shall contain as little as possible of the constituents specially required for cell-formation; *i.e.* cholesterin, lecithin, and earthy and alkaline phosphates; and with this object in view he avoids *vegetable* as well as *animal* foods which are relatively rich in these substances, and chooses those vegetable substances in which the carbohydrates largely predominate.

Part II.

FOOD IN DISEASE.

In almost every period in the history of medicine the importance of dietetics in the treatment of disease has been universally recognised; but at no period has the therapeutics of food obtained so careful a study and so wide an application as in the present day. Our more complete knowledge of the processes of digestion and metabolism as they occur in health, and of their disturbances in disease; our enlarged and more accurate acquaintance with the chemical composition of alimentary substances, as well as of their purposes in nutrition, have contributed greatly to the growth and development of this branch of therapeutics.

In the management of all morbid conditions a suitable adaptation of the food to the altered state of the organism is of the highest importance. In none is it of more consequence than in the treatment of acute diseases. There was a tendency at one time to injuriously limit the dietary of fever patients; the tendency, in the present day, has perhaps been to err in the other extreme. In no department of medical practice is *judicious discrimination* of so much consequence.

In the administration of food in disease we have to pay especial regard to the state of the digestive and assimilative organs as influenced by the existing pathological processes.

In many diseases, indeed in all febrile diseases,

CHAPTER I.

FEEDING IN ACUTE DISEASE AND CONVALESCENCE.

It is scarcely necessary in the present day to enter into any protracted discussion as to the propriety of feeding or of withholding food from patients who are suffering from febrile maladies. Since the time when Graves claimed as his chief title to the gratitude of posterity that "he fed fevers," there has been little serious inclination to go back to the starving methods of some of his distinguished predecessors or contemporaries. To "feed fever" is now the popular practice, and, in some instances, it has, probably, been carried to an injurious excess.

The conclusion of some of the older physicians that the administration of food tended to increase the fever in cases of acute disease, rested, no doubt, on some basis of practical observation, and we are well aware now that the careless and indiscreet administration of food, unsuitable either in quality or quantity, or in both, is most harmful in febrile maladies.

Cautious and careful administration of food, based on the principles we are about to state, will, we believe, be found most in accord with practical experience, as well as with scientific experiment.

It is an universally acknowledged fact that all febrile states are accompanied by an increased waste or consumption of the tissues of the body, so that there occurs a considerable loss of body-weight, usually proportioned to the intensity and duration of the fever.

But the whole of this loss of substance is not necessarily due to the febrile process alone, whatever

and inability to digest solid food, which, if administered, is often vomited.

As we have already said, it used to be taught that the administration of albuminous food in fever was injurious, and had the effect of intensifying the consumption of the tissues, and was, in short, "pouring oil on the fire;" and even within the last twenty years it has been attempted to support this view by experimental observations. As they were, however, altogether inconclusive, it is not necessary to quote them here. On the other hand, Bauer and Künstle, by careful observation of the diet of typhoid patients, have completely established the fact that by a due "supply of albuminous food to a fever patient a saving of albumen in the body may be effected; for, though the excretion of nitrogen is increased, the loss of the same element from the system is reduced."* But Bauer, while he maintains that the loss of albumen in febrile subjects is lessened by the administration of albumen, yet concludes that it is unlikely in highly febrile states it can be entirely prevented; "for," he argues, "while under normal conditions a sort of equilibrium is constantly maintained between the nutrient fluids and the tissues, any excess of nutrient material being speedily removed, partly by increased metabolism and partly by an accession of substance, this equilibrium appears to be more or less disturbed in fever.

"The circulating current of albumen is abnormally great in proportion to the mass of cells; but the heated cells cannot assimilate this excess, since they have lost, at least in part, the capacity for taking up and turning material to their own use. A nitrogenous equilibrium cannot be attained in patients with high fever, even if they were in a condition

* Bauer, "Dietary of the Sick."

the digestive powers are more active during these periods.

There is one other preliminary consideration we must also bear in mind, viz. that there is in some cases a tendency to accumulation in the body of the products resulting from the destruction of the tissues; and, as these act as poisons in the blood, we must be careful to administer such food as shall favour their elimination, and not lead to any increased accumulation in the body of nitrogenous waste.

Having thus passed in review the more important principles which should determine the alimentation of patients affected with acute febrile maladies, we may now pass on to the consideration of the best means of practically applying them.

If the febrile attack is an acute and short one—as is seen, for example, in a typical case of croupous pneumonia of moderate severity and with early crisis—there is no need for any anxiety as to the consumption of much food, unless old age or previous debility affords a special indication for actively supporting the bodily strength. By forcing the consumption of a considerable quantity of food in such cases, in the absence of all appetite and with obvious febrile disturbance of the digestive organs, more harm than good will be done.

All authorities are agreed that the food of fever patients should be in the *fluid* form,* such as can be

* Sir William Roberts observes:—"In forming a plan of dietary for the sick, distinction must be made between gastric and intestinal digestion. In healthy persons and invalids of the slighter sort, we must have regard mainly to gastric digestion; but in the seriously sick the stomach becomes often inoperative, and digestion becomes almost exclusively intestinal. The sympathy of the stomach with the general condition of the system is much more active and close than that of the intestine; the former organ approximates more nearly to the animal life of the body, the latter more nearly to the vegetative life. The seriously sick,

be on the watch for any signs of indigestion of milk in cases of acute disease; and in these cases milk should always be given with certain precautions. It should be previously boiled. It should be given *diluted*—either with water or, better still, with an effervescent alkaline water: equal parts of milk and Vichy or Vals water, or one part of milk to two of Apollinaris or soda-water; or ten grains of bicarbonate of soda and the same quantity of common salt may be added to every pint of milk and water (equal parts). Milk thus diluted and mixed with alkali can often be absorbed when pure undiluted milk would be undigested. As a fever patient necessarily requires, as we shall presently see, much water as a beverage, we need have no hesitation in freely diluting his milk. The diluted milk should be given frequently in small quantities at a time. Two ounces of milk with two ounces of alkaline water every hour would give the patient two pints and a half of milk a day, and a fever patient requires a drink every hour. This quantity, of course, may be increased and the intervals lengthened in many cases. We are now speaking of cases in which the digestion of milk is difficult.

In instances where milk even thus diluted appears to disagree, it may be well to give an equivalent quantity of *whey*. This is milk from which the curd and much of the fat have been separated by previous coagulation and straining. It can readily be made by boiling a pint of milk with a teaspoonful or two of lemon juice, and then straining through muslin and expressing all the fluid from the curd.*

This may be made more nutritious, if necessary,

* If the curd be well broken up after coagulation and all the fluid thoroughly pressed out of it, much of the fat and some of the finely-divided casein of the milk will pass into the whey, and thereby much increase its nutritive properties.

it may be as well to quote a few authoritative opinions.

Germain Sée, who has been quoted in the paper referred to as if he were an opponent of beef-tea, mentions the following as "*one of the best fluid foods:*" *—Meat cut into small pieces, cold water added, and then gradually heated to 140° or 160° Fahr. He does not mention what relative quantity of water, but whether much or little it is essentially the same as beef-tea. He points out also that it contains important salts—important as mineral foods—especially chlorides and sulphates, combined with potassium.

Subsequently he speaks of beef-tea as made by placing fragments of beef in a hermetically sealed vessel, and exposing it for several hours to a water-bath; this is a means, as he points out, of extracting all the *gelatin* of the meat. "It is true," he goes on to say, "gelatin by itself has not the same nutritive value as the albuminates, and in any case it is necessary to prescribe it in considerable quantities to attain the same end. *We may do so with impunity, for jellies are well tolerated and easily digested.* But in reality these are only auxiliary means of *conservation of our organic tissues—des moyens d'épargne*" [a *means of saving the tissues*—what could be more important in diseases in which the tissues are being destroyed?]. "*From this point of view gelatin* cannot *be too strongly recommended*, prepared in the most various forms, and with a variety of flavours."

Again, in the same paper, G. Sée is quoted as depreciating beef-tea to the advantage of milk. This is what Prof. Sée says of milk in fevers:—"As soon as the functions of the stomach are disturbed *milk digests badly*, it forms clots in the stomach accessible with difficulty to the gastric juice, and often leaves that organ unpeptonised. . . . . Although we may then

* "Du Régime Alimentaire: Régime des Fiévreux," p. 385.

costly than wine. In many cases in which there is no marked disturbance of digestion it may, he thinks, "be allowed without hesitation."

It must be borne in mind that the light German beers are much more suitable for this purpose than the beers we are accustomed to in England.

Our own experience has led us to regard brandy or whisky, well diluted, as the best form of alcohol to give during the acute febrile stage, and that port wine or champagne is more useful during the period of convalescence; or, if the patient prefers a good claret or Burgundy at this time, there is no objection to his having an equivalent quantity of these wines.

During *convalescence* from acute febrile maladies great care is still needed in the supervision of the diet. This is especially the case in convalescence from typhoid fever, when great firmness is often needed in resisting the patient's urgent entreaties for a more liberal and varied diet. The appetite is often voracious, and the craving for food, after the prolonged period of inanition he has passed through, is almost irresistible. But it must always be remembered that the digestive powers are still very limited and that any solid food that escapes digestion in the stomach may act as an irritant in passing along the intestines, still the seat of slowly-healing ulcerative and inflammatory processes.

It has been, again and again, observed that the smallest indulgence in solid food during the first few days of convalescence from typhoid is frequently followed by a rise of temperature and sometimes by a serious relapse.

It is needful, therefore, that for the first week or ten days of convalescence a fluid dietary should still be maintained: a little well-soaked bread-crumb, rubbed through a fine sieve, may be added to clear soups or beef-tea, or these may be slightly thickened with

CHAPTER II.

THE DIETETIC TREATMENT OF DISEASES OF THE DIGESTIVE ORGANS — ACUTE AND CHRONIC GASTRIC CATARRH—GASTRIC ULCER—CANCER OF STOMACH —DILATATION OF THE STOMACH—DYSPEPSIA— CONSTIPATION—DIARRHŒA.

DISEASES or disorders of those organs which are actually concerned in the digestion and assimilation of food must necessarily and especially be greatly under the influence of appropriate dietetic treatment. The subject, however, of the dietetic treatment of diseases of the organs of digestion is a complicated and difficult one, as it involves some obscure and disputed points in connection with the physiology of digestion, and as it is associated with many controversial questions in which the general public take a prominent interest.

It will be our object here to avoid, so far as possible, the introduction of matters which are especially open to dispute, and to strive to make our teaching as simple and practical as possible, and in harmony with the ripe experience of competent, careful, and unbiassed observers.

It is most important also to keep in view the fact that we are now dealing with questions which are remarkably subject to individual peculiarities, and that the widest divergences of opinion may often be found to rest on the apparently indisputable basis of personal experience. So that after framing general dietetic rules, we must be prepared to exercise much discrimination in their mode of application; for food that is readily digested by one person will often prove hurtful to another; and even in the same person

Game or fish kept too long, entrées made with meats that are not perfectly fresh, new beer and sour wine, and in young children milk that is not quite fresh, are fruitful sources of gastric catarrh.

Too free use of spices and stimulating condiments, but especially the habit of taking alcohol in a concentrated form, lead to the same result.

In *severe* cases of acute gastric catarrh, the indication with respect to food is to so limit it in quantity and quality that the acutely inflamed mucous membrane shall be spared all irritation or excitement from ingesta, and the whole organ be, so far as is possible, put in a condition of physiological rest. Entire abstinence from food, at least from food by the mouth, may often be enforced with advantage for a day or two, or so long as the taking of food excites nausea, or vomiting, or severe pain. This abstinence is usually well borne, except in cases where the strength has been exhausted by previous suffering, and long inability to digest a sufficient quantity of food; in such cases nutrient enemata may for a time be given, so as to secure the rest needed by the hyperæmic and irritated gastric mucous membrane; while small quantities of iced water may, from time to time, be taken into the stomach.

When, however, there is a great craving as well as a real need for food, fluid nourishment only must be carefully administered. In the selection of such fluid foods it must be remembered that the gastric secretion is alkaline, from admixture with mucus; that its digestive power is, therefore, greatly impaired, and that there is a great tendency to abnormal decomposition of food in the stomach. Milk, if given undiluted, or eggs, or any food requiring acid gastric juice for digestion, may be found to disagree. In such cases we should dilute the milk with an equal quantity of soda- or lime-water, and in some instances admixture

there enforced, effects some brilliant cures in obstinate cases of chronic gastric catarrh. The employment of an *exclusively milk diet* in the chronic gastric catarrh induced by abuse of alcohol is strongly advocated by Dujardin-Beaumetz, who also insists on the value of the addition to the milk of some alkaline water or bicarbonate of soda.*

The rules that should direct the dietetic treatment of cases of **ulcer of the stomach** are few and simple.

In the first place, we must avoid all food that can, either mechanically or chemically, irritate the surface of the ulcer.

Secondly, we must avoid the use of food that is calculated to stimulate the acid secretions of the stomach, for this will act as an irritant to the raw, ulcerated surface.

Thirdly, we must avoid *distending* the stomach with much food at a time, for by maintaining the stomach in a contracted state, its mucous membrane is thrown into folds, so that the margins of the ulcer are relaxed and its extent diminished—conditions favourable to filling up and healing of the ulcer.

Fourthly, any excitement of the muscular movements of the stomach should be, so far as possible, prevented.

Lastly, in cases of perforating ulcer, where severe and dangerous hæmorrhages have occurred and may recur, keep the stomach absolutely at rest, for two or three days at least, and feed the patient with nutrient enemata, to which, if necessary, a little brandy or port wine may be added, allowing only a few fragments of ice to be sucked in order to allay thirst.

In most ordinary cases, restriction to an exclusively milk diet will answer the indications given above.

* "L'Hygiène Alimentaire," p. 211.

We have seen such patients fed with soft farinaceous foods with the idea that they were bland and unirritating, the consequence being that frequent vomiting and much gastric distress were induced. Upon an entire suppression of the farinaceous foods and an absolute restriction to concentrated meat solutions and foods that could be absorbed in the stomach, or, on account of their perfect fluidity, that pass readily into the small intestine, the vomiting and distress have immediately ceased.

If the cancerous growth should involve some other region of the stomach, there is then not the same objection to the carbo-hydrates, because there is not the same risk of their being retained long enough to undergo abnormal decomposition in the stomach.

Food in cancer of the stomach, speaking generally, should be fluid, and sufficiently concentrated to supply the necessary nourishment in a *small* bulk. When milk is well borne, no better food can be taken. It is well, however, to dilute it slightly with some alkaline water; and peptonised milk will often be found to agree when ordinary fresh milk will not.

Should any considerable hæmorrhage from the stomach occur during the course of the disease, it may be necessary to limit the administration of food for a time entirely to nutrient enemata, so as to keep the stomach free from any irritation or functional excitement.

We are quite in accord with Professor Bauer in his contention that "in carcinoma of the stomach, animal, highly-albuminous foods—as milk, eggs, and tender meat—are decidedly preferable to those which, from the large amount of hydro-carbons they contain, are easily prone to abnormal and acid fermentation."* And we entirely doubt the accuracy of

* "The Dietary of the Sick," p. 253; Ziemssen's "Handbook of General Therapeutics."

The more chronic forms may be associated with either (1) a hyperæsthesia of the gastric mucous membrane; (2) insufficient amount or altered quality of gastric secretion; (3) imperfect disintegration of the food in the mouth; or (4) loss of tone in the muscular coat of stomach.

The symptoms are so well known as scarcely to need repetition here, and are much the same as those of chronic gastric catarrh already enumerated: a sense of weight and discomfort in the epigastrium coming on soon after taking food, and in some instances (hyperæsthesia of gastric mucous membrane) amounting to acute pain; flatulent distension of stomach and intestines, often accompanied with sighing, and by dyspnœa and palpitation on exertion, due to pressure upwards against the diaphragm of the distended stomach; eructations of the acid contents of the stomach, causing a burning pain about the cardiac orifice of the stomach, or "heart-burn." These symptoms are often accompanied either by headache and general lassitude, or by restlessness and irritability. Occasionally there may be vomiting.

In all such cases our first duty is to inquire carefully into the habits of the patient, both as to the food he takes and as to his manner of taking it.

Imperfect mastication, from haste in feeding, or from defective teeth, or from habitually taking food difficult of disintegration in the mouth, is, perhaps, one of the most common causes of dyspepsia in persons of feeble digestion or of advanced age. It is important to remember that the digestive function, the function of the solution of the food, *begins in the mouth*, with the very important acts of mastication and insalivation. The mechanical disintegration of the food by the action of the teeth and jaws is essential to its complete digestion lower down in the stomach and intestines; for without this reduction of

pearl barley, macaroni, and vermicelli; these may be taken plain or with butter.

Fresh Vegetables also in the form of *purées*—carrots, turnips, and the other vegetables used in making Julienne soup; *purée* of green peas, well-cooked salads, spinach, sorrel, French beans.

Fruits should, with the exception of grapes, be cooked, and taken as *compôte.*

With such a *régime* he permits *lightly-cooked eggs*, and he does not forbid beer.

Professor G. Sée divides dyspeptic patients, somewhat arbitrarily, into two groups—those who secrete too much hydrochloric acid (*dyspepsie hyperchlorhydrique*) and those who secrete none (*dyspepsie achlorhydrique*). For the first he recommends a nitrogenous diet and the avoidance of starchy food; and for the second he advises a wholly vegetable diet. To the first he gives bicarbonate of soda after meals; to the second hydrochloric acid. *

Professor Sée advocates strenuously the value of the alkaline (bicarbonate of soda) water of Vichy, taken an hour or half-an-hour before a meal, in all cases of *dyspepsie chimique.*†

Leube, the celebrated German specialist for diseases of the stomach, has found the four following dietaries as applicable to the different degrees and stages of digestive disorders. No. 1 is considered to be the most easy of digestion, and is suitable, therefore, to the most severe cases of dyspepsia; No. 2, the next easiest; and so on up to No. 4.

No. 1.—Broth, or clear soup (*bouillon*).
Solution of meat (Leube's special preparation).
Milk.
Eggs, raw or very lightly cooked.

* "Des Maladies de l'Estomac jugées par un nouveau Réactif Chimique."—*Acad. de Méd.*, January, 1888.

† "Du Régime Alimentaire," p. 319.

and constipation thus induced. Similarly it may be caused by the abuse of aperient medicines.

In dealing with all such cases, it is essentially necessary to make careful inquiry into the habits of each patient with regard to the quantity and nature of the food he takes, so that we may make such corrections as may seem necessary to overcome the morbid habit.

In some instances we may discover that too *dry* a diet is taken, and that not enough water is consumed to keep the contents of the intestinal canal in a fluid, a semi-fluid, or soft condition.

The freer the supply of water to the blood, the more fluid the intestinal secretions are likely to be; whereas if the supply of fluid to the blood be limited, less fluid is likely to be secreted from the intestinal glands, and the intestinal mucous membrane will become drier. It is, no doubt, for the reason here indicated that free draughts of cold water taken at bed-time and in the morning fasting will often succeed in overcoming habitual constipation.

Persons who lose much water from the surface by profuse perspiration should also remember this, if they find they suffer from constipation; and that it may be, to some extent, due to an abnormally dry state of the intestinal mucous membrane, brought about by an excessive loss of fluid from the skin.

Persons who avoid fresh vegetables and fruit should be induced to habitually add some of both to their diet.

Green vegetables, and ripe or stewed fruits—as apples, pears, prunes, figs, etc.—and the various kinds of brown or whole meal bread, are well known to have an aperient tendency. This is due to the mechanical irritation which the undigested residue of such foods exerts on the intestinal mucous membrane.

decomposition into irritating acid substances in the alimentary canal.

Especially to be avoided are green vegetables, raw acid fruits, nuts, potatoes (unless in the form of *purée*), coarse brown bread, and all rich, fat, or acid dishes; also all forms of animal food which are hard or tough and difficult of digestion, such as pork, veal, and beef —unless reduced to pulp or powder.

Milk, preferably boiled, is usually a good food in diarrhœa, unless we find some individual peculiarity rendering it difficult of digestion, and in such cases we must order unirritating farinaceous foods, such as arrowroot, tapioca, sago, rice, etc., prepared with water and flavoured with nutmeg, cloves, or cinnamon. An acute attack of diarrhœa will often be rapidly cured by restricting the food for twenty-four hours to water arrowroot, flavoured with the spices we have just named, and with the addition of two or three teaspoonfuls of brandy, or a tablespoonful or two of port wine, to each teacupful. When beef-tea or clear soup is ordered in these cases, it should be thickened with arrowroot, sago, or tapioca.

Soda-water and milk, with a small quantity of brandy, is the best beverage in these acute cases; or port wine and water may be substituted when preferred.

After the subsidence of the acute attack, the return to the ordinary diet should be gradual, and for a few days clear soup or beef-tea, thickened with the substances we have named, boiled chicken, partridge, or pheasant with rice, or boiled whiting or sole and a little mashed potato, should be the chief articles of diet. All acid wines and beer must, during this period, be prohibited. The tannin wine of S. Raphael may, however, be permitted.

The dietetic treatment of chronic diarrhœa is a somewhat more troublesome matter. According to

per cent. solution of lactic acid, a teaspoonful to be given a quarter of an hour after suckling.

Dr. Stange advocates the koumiss cure in some cases of chronic diarrhœa, and he mentions one which persisted after an attack of epidemic dysentery, and in which different modes of treatment had been tried for four years, "but the slightest indiscretion in diet invariably brought on the diarrhœa. Six weeks after the commencement of the koumiss cure he had gained 4 kilos., and could take any kind of food with impunity." *

* Von Ziemssen's "Handbook of General Therapeutics," vol. i.

The difference in the views propounded by C. Bernard and those held by Pavy is simply as to the destination of the amyloid substance, the "glycogen," which both admit is formed in the liver, and which both admit is exceedingly prone, as one of its chemical properties, to pass into sugar.

Bernard taught that the glycogenic function of the liver was to regulate the supply of sugar to the blood, in which fluid it was consumed and applied to force-production; Pavy contends that *in health* the glycogen in the liver does not undergo any such conversion, that its probable destination is to form fat, and that the conversion of sugar into "glycogen' by the liver prevents the sugar from passing into the blood to any material extent, and so saves us from being *diabetic!*

We are here, however, only indirectly concerned in the discussion of the pathological theories that have been advanced to account for the diabetic state; our present purpose is the practical one of determining the most suitable kind of food for diabetics, so as to arrest or check their glycosuria; the amount and persistence of which may generally be taken as an indication of the gravity of the malady.

The principal rule which should govern the construction of a dietary for the diabetic is to exclude from it, as far as possible, all those articles of food that can be converted in the organism into sugar.

Having composed such a diet, and applied it to any particular case of diabetes, the prognosis of that case will, in a great measure, depend upon what we observe to be the result of that diet; if the amount of sugar in the urine diminishes rapidly in quantity, and ultimately disappears, the prognosis is favourable; if it persists, or diminishes but slightly in quantity, the prognosis is unfavourable.

In practice we certainly encounter cases of diabetes

the other hand, noticed that in the grave forms of diabetes, muscular exercise has been badly borne.

Besides, however, the objections which diabetic patients themselves make to a diet composed exclusively of meat and fats, it is highly probable that such an exclusive diet may be itself injurious to some of them. It certainly tends to aggravate the tendency observed in many diabetics to an increased excretion of the nitrogenous elements of the urine, and especially to the formation of uric-acid deposits to which some of them are prone. It has also been stated by Ebstein and others that an exclusively animal (meat) dietary favours the development of *acetone* in the blood.

Some years ago it was stated by Dr. Scott Donkin that he had obtained excellent results in the treatment of diabetes by an *exclusively milk diet.* His system was to limit the food to *skimmed* milk, of which the patient was ordered to consume at first four to six pints a day, which quantity was slowly increased to 12 pints. The milk was taken warm, and a portion of it, about one-third, was converted into curds and whey; and Donkin maintained that at the end of a fortnight the sugar entirely disappeared from the urine. Although this method was never largely adopted, and although it was found to be badly borne by many diabetics, yet there can be little doubt that it agreed well with a few.

Many physicians (Bouchardat, Germain Sée, Dujardin-Beaumetz) discard milk entirely from the diet of diabetics.

Sée says: "I consider milk to be counter-indicated at all periods of the disease, and, like Frerichs, I have always seen the sugar in the urine greatly augmented under its influence."*

Dujardin-Beaumetz testifies to the same effect:

* "Du Régime Alimentaire," p. 522.

"The patient," Sir W. Roberts says, "continued to gain weight, and to improve in her general condition under the use of milk, although the density of the urine and the excretion of sugar somewhat increased. A limited supply of milk may therefore be allowed." *

There are, as might be imagined, great practical difficulties in constructing a satisfactory dietary for diabetics exclusively of albuminates and fat; indeed, the quantity of fat necessary to supply the requisite amount of carbon needed in the system is with difficulty appropriated by the organs of digestion; and to attempt to meet the demand for carbon by albuminates alone would necessitate a quantity of such foods altogether unmanageable.

We are, then, in the end driven to adopt a *mixed* diet, the different articles of which have to be selected with especial regard to the amount of sugar-forming material they contain, choosing of course those which contain the minimum, and always looking to the albuminates and fats as the chief nutritive elements of the dietary.

And, first, with regard to *bread*. This forms so important an article in the habitual daily dietary of the healthy, and the ordinary kinds of bread are so rich in carbo-hydrates, that the ingenuity of physicians has been greatly taxed to produce a bread for the diabetic which shall prove a satisfactory substitute for ordinary bread.

Bouchardat suggested gluten bread as a suitable food for the diabetic; this is a bread made of wheat flour, deprived by repeated washings of as much of its starch as possible.

But gluten bread is never entirely free from starch: and unless it is prepared with great care and by known manufacturers, may even contain a considerable

* "A Practical Treatise on Urinary and Renal Diseases." Fourth edition.

adding a little nutmeg and ginger, or any other agreeable spice. Bake in small tins (patty-pans), which must be well buttered, in a rather quick oven for about half an hour. The cakes, when baked, should be a little thicker than a captain's biscuit; they may be eaten with meat or cheese at breakfast, dinner, or supper; at tea they require rather a free allowance of butter, or may be eaten with *curd* or any of the soft cheeses.

"It is important that the above directions as to *washing* and drying the bran should be exactly followed, in order that it may be freed from starch, and rendered more friable. The bran in its common state is soft, and not easily reducible to fine powder. In some seasons of the year, or if the cake has not been well prepared, it changes more rapidly than is convenient. This may be prevented by placing the cake before the fire for five or ten minutes every day." These cakes are made by Blatchley, 167, Oxford Street, London. Sir William Roberts suggests the use of seven eggs instead of three, as an improvement, also the addition of a teaspoonful of bicarbonate of soda.

"Torrified" bread, made by toasting thin slices of ordinary bread before the fire until they are deeply and thoroughly browned—almost blackened—so that the starch and gluten are in great part destroyed by the heat, is a highly acceptable form of food to some diabetics.

Pavy introduced almond cakes as a substitute for ordinary bread, and it is, undoubtedly, a valuable one. By washing the meal of sweet almonds with acidulated water, the greater part of the sugar is removed, and the meal so treated may by careful preparation be made into a palatable cake or biscuit.

Seegen also advocates the use of almond cakes, and gives the following recipe for making them:—

Take of blanched sweet almonds ¼ lb., beat them

As to wines, it is desirable to notice which kinds (of those generally permitted) are best borne by different diabetics.

All saccharine wines (ports, champagnes, Sauternes, etc.), liqueurs, and beer must be strictly avoided.

To resume : the following are the *indications* to be satisfied in fixing a *régime* for the diabetic, as formulated by Professor G. Sée :—

1. Reduce to a minimum or abolish altogether all sugar-forming foods, *i.e.* all substances containing starch or sugar.

2. Raise to the physiological maximum all flesh foods, *i.e.* give as much animal food — meat of all kinds—as can be well digested and assimilated.

3. Find suitable substances to replace the necessarily discarded *carbo-hydrates*—and these are to be found amongst the various animal and vegetable fats. Their richness in carbon renders them fitter for this purpose than albuminates.

4. Promote muscular activity in order to consume the excess of sugar in the blood.

This last indication must be applied with discrimination ; and it must be remembered that in the graver forms of diabetes—the thin, wasted diabetics —much muscular exercise is ill borne ; on the other hand, the stout, gouty, glycosuric patients are doubtless benefited by exercise.

I have already alluded to the value of alkaline water in diabetes. They often prove of so much use that they may be regarded as forming a fit part of the diabetic *régime.*

Their use is frequently attended by a diminution of the excessive thirst, a disappearance of the distressing dryness of the mouth, by a less frequent need to pass water, and by a removal of cutaneous irritation and eruptions.

Sanctioned:	*Forbidden:*
Poultry and game.	Sago, tapioca.
Fish of all kinds, fresh and cured, including the crustacea.	Macaroni, vermicelli.
Animal soups, beef-tea, and broth (not thickened).	Potatoes, carrots.
Eggs, cheese, cream cheese, cream, butter.	Parsnips.
Almond, bran, or gluten substitutes for ordinary bread.	Beet-root.
Greens, spinach.	Peas.
Turnip-tops, watercress.	Spanish onions.
Mushroom, mustard-and-cress.	*Pastry and puddings of all kinds.*
Cucumber, lettuce, endive.	Fruits of all kinds, fresh and preserved.
Radishes, celery.	
And the following only in moderate quantity, after boiling in much water:	
Turnips, French beans.	
Brussels sprouts, cabbage.	
Cauliflower, broccoli, sea-kale.	
Asparagus, vegetable-marrow.	
Pickles, olives, vinegar, oil.	
Jelly, flavoured, but not sweetened.	
Savoury jelly.	
Blanc-mange, made with cream and not milk.	
Custard, made without sugar.	
Nuts of all kinds, except chestnuts.	

Beverages.

Tea, coffee, cocoa from nibs.	Milk, except sparingly.
Dry sherry, claret, hock.	Sweet ales, mild and old porter and stout, cider.
Dry Sauterne, Chablis, Burgundy.	All sweet and sparkling wines.
Brandy and spirits, unsweetened.	Port wine, unless sparingly.
Soda-water.	Liqueurs.
Burton bitter ale in moderate quantity.	

3.—SIR WILLIAM ROBERTS'.

Sanctioned:	*Forbidden:*
Butchers' meat.	All saccharine and farinaceous foods.
Poultry and game.	Bread, potatoes.
Fish.	Rice, tapioca, sago, arrow-root, macaroni, etc.
Cheese.	Turnips, carrots, parsnips, beans and peas.
Eggs.	Liver (contains much sugar-forming substances), and therefore
Butter, fat, and oil.	Oysters, Cockles, Mussels { containing enormous livers.
Broths, soups, and jellies, made without meal or sugar.	The "pudding" of crabs and lobsters.
Cabbage, endive, spinach.	*All sweet fruits*, as apples, pears, plums, gooseberries, currants, grapes, oranges, etc.
Broccoli, Brussels sprouts.	
Lettuce, spring onions.	
Watercress, mustard-and-cress	
Celery.	
Substitutes for bread:	
Bran-cake, gluten bread (and meal), almond meal, rusks and biscuits.	
"Torrified" or charred bread.	

Beverages.

Dry sherry, claret, bitter ale.	Port and all sweet wines.
Brandy and whisky (in small quantities).	Sweet ales and porter.
Tea, coffee (no sugar), chocolate (made with gluten meal), soda-water, bi-tartrate of potash water.	Rum and sweetened gin.

4.—GERMAIN SÉE'S.*

1.—He permits all kinds of animal flesh, boiled or roasted.
   Ham, bacon.
   All kinds of fish, crustacea, oysters.
   Eggs, cheese (well-kept).
2.—Fats of all kinds, butter, lard, and sauces without flour.
3.—He permits 5 *oz. of bread or potatoes* daily.
4.—Also roots and green vegetables.
5.—Saccharin, to replace sugar.
6.—He forbids *milk* as a general rule.
7.—He considers the best beverages to be wines that are not sweet, and tea and coffee, without sugar.
8.—He recommends Vichy water before meals, especially in gouty cases.

* "Du Régime Alimentaire." Paris. 1887.

Beverages.

Claret or Burgundy	For men 1 pint to $1\frac{1}{2}$ pint daily.

7.—CANTANI'S.

(*This is a very exclusive diet.*)

Sanctioned:	*Forbidden:*
Meat and animal fats of all kinds (at all meals).	*Liver.*
Fish of all kinds.	*Butter*, as it contains traces of lactose.
Lobsters.	*Cheese.*
Olive oil (instead of butter).	*Milk.*
Eggs (in *milder* cases).	*All farinaceous and saccharine foods* absolutely.
Substitute for bread: Pavy's almond cakes (only for convalescents who cannot entirely dispense with bread).	All fruits.
	All green vegetables and roots.

Beverages.

Pure water.	Lemonade.
Soda-water.	Chocolate.
Persons habituated to the use of strong wines and spirits may add to the water 10 to 30 grammes of pure alcohol daily.	Vinegar.
Red wine.	Rum, Cognac.
Tea and coffee in small quantity in *milder* cases.	Tea and coffee (in *severe* cases).

Cantani considers much salt injurious, as well as much pickled pork or salt fish.

He requires the adoption of this absolute meat and fat diet for three months—in very mild cases for two months, in very severe cases for six or nine months. If after two months the urine contains no sugar, he allows green vegetables; after another month, cheese and old red wine; and after another fortnight, almonds and nuts. A month or so after this, he permits juicy fruits, not too sweet, as strawberries, raspberries, peaches, apples, and sour oranges; still later, plums, gooseberries, green beans and peas,

Vegetables, prepared with much fat; *purées* of leguminous plants. *Salads*, dressed with vinegar and oil, and some cream.
The food should be well salted and spiced.
After dinner, a cup of coffee or tea.

SUPPER.

One cup of tea or broth.
Meat roasted, ham or cheese, or an egg, or fish, caviare.
Bread, 30 to 50 grammes, with *butter*, 20 to 30 grammes.
Apples, pears, and stone fruit are allowed in small quantities.
Beverages.—He forbids absolutely the use of beer, limits the use of spirits, and allows about half a bottle of wine daily.
If the patient digests *milk* well, he allows it in moderate doses, and cream especially.

9.—DÜRING'S.

This dietary differs from most others, and is founded on the theory that the most important factor in the causation of diabetes is a faulty diet and disturbed digestion; Düring therefore insists only on a restricted diet and the selection of the most digestible foods.

FOR EARLY BREAKFAST.

Milk, with a little coffee, but no sugar (some lime-water to prevent milk from becoming sour in stomach).
Stale white bread, *ad libitum.*
Or oatmeal, barley, or rice-gruel, made with water, a little salt, but no butter (if bread cannot be borne).

FOR 2ND BREAKFAST.

White bread, stale and well-baked.
An egg lightly boiled.
Rice or oatmeal gruel, with or without milk, a breakfast-cupful.
Or half a glass of good red wine (with water in certain cases).

FOR DINNER (TAKEN BETWEEN 2 AND 3 O'CLOCK).

Soup, with rice, barley, or oatmeal.
Meat, roast, 250 grammes (game, ham, and smoked meats as free from fat as possible, are permissible), no condiments, *no fatty sauces.*

Compôte of dried apples, plums, cherries.
Dried peas or white beans, in some cases.
Green vegetables, asparagus, French beans, carrots, cauliflowers, cabbages (boiled in water with salt, not with fat or stock).
Dessert of a little raw fruit, apples, cherries, and one small glass of red wine, diluted with water.

FOR SUPPER (ABOUT 7 P.M.).

Gruel of barley, oatmeal, or rice, with salt (but no butter), and strained. In some cases may be made with milk.
Ice or iced water, to relieve thirst between meals.

He lays great stress on the mode in which these vegetable foods are prepared; especially the cereals used for making gruel and the legumes are, before being cooked, to be steeped for some time, and boiled long enough to make them more easily digested.

CHAPTER IV.

DIET IN ALBUMINURIA.

THE presence of albumen in the urine occurs under a variety of circumstances differing greatly in their significance and seriousness. Some of the abnormal conditions which give rise to the presence of albumen in the urine are temporary and comparatively unimportant, others are more or less permanent and of extreme seriousness.

It is to the latter that the term "chronic Bright's disease" is usually applied, and the morbid condition then associated with the albuminuria is the existence of organic structural changes in the kidneys themselves. These are cases of "chronic renal" disease.

The presence of albumen in the urine occurs also temporarily in the course of many acute febrile disorders, as, for instance, in the *exanthemata*, especially in scarlet fever, in diphtheria, and indeed in nearly all severe forms of acute febrile diseases in some part of their course.

Some of the instances of *chronic* Bright's disease no doubt originate in *acute* inflammatory affections of the renal organs, "acute Bright's disease," and these may occur without the coexistence of any other febrile malady.

Albumen may occasionally and temporarily be present in the urine in connection with dyspepsia, and from improper feeding, or from over-exertion, too rapid growth, and other debilitating influences.

Albuminuria from passive hyperæmia of the renal vessels, as a part of that general venous obstruction dependent on chronic heart and lung disease, forms a part of the clinical history of those affections, the

It has also been shown by several observers that egg-albumen injected into the veins of animals (Stockvis), or under the skin (Semmola), or into the rectum, is followed by albuminuria. There is nothing to be wondered at in this, seeing that the albumen injected in these experiments has not undergone any digestive changes, has not been peptonised, is, therefore, in an unassimilable condition, and is consequently excreted from the blood by the kidneys; whereas when serum-albumen—*i.e.* albumen which has undergone the digestive process and become assimilable—is similarly injected no albumen appears in the urine.

But it has been also asserted that egg-albumen taken *into the stomach* in large quantity will cause albuminuria.

Setting aside individual peculiarities (a few individuals can never take eggs in any form without suffering disturbances of health), great discrepancies occur in the observations made as to this point by different experimenters.

Stockvis and some others have stated that in animals and in themselves they have found that when egg-albumen (uncooked) was taken into the stomach in large quantity a portion of it was excreted in the urine. Stockvis suggested as an explanation of this fact that a portion of the uncoagulated albumen entered the blood unaltered, and was, therefore, eliminated as unassimilable. Nussbaum, Coats, and D'Arcy Power claim to have seen albuminuria produced in the same way. Lauder Brunton, however, failed to produce albuminuria by swallowing six raw eggs in succession; and Dr. Maguire swallowed the whites of twelve raw eggs without producing albuminuria.

Another observer* ate nineteen raw eggs in thirty-six hours without producing albuminuria.

* Dr. Dobradin quoted by Grainger Stewart.

And in the fourth, a case of chorea, "the eggs were not well borne by the stomach," and the albumen in the urine may, therefore, have been the result of dyspepsia.

We should be disposed to take exception to all but one of these cases.

The well-known digestive abnormalities of the ataxic should have rendered such a patient unsuitable for a test experiment; and the presence of "mitral incompetence" would give so great a tendency to venous hyperæmia, that the occurrence of slight temporary albuminuria might be readily provoked.

The occurrence of temporary albuminuria under circumstances like these has been explained by the suggestion that the blood, becoming surcharged with albumen, some of the excess escapes by the kidneys; but may not the true explanation be that the ingestion of so large an excess of albuminous material may throw upon the kidney such an excess of nitrogenous waste (to be excreted), that a temporary functional hyperæmia of the kidneys is excited, and that this leads to a slight escape of albumen from the blood? It appears to us that this is a sound physiological explanation of what is observed to occur, and accounts for its occurrence in feeble or disordered constitutions, and not in the perfectly sound and vigorous.

Dr. Grainger Stewart also tested the effects of some other articles of food, as cheese and walnuts, and came to the conclusion that, although "particular articles of diet induce albuminuria in some people, yet the quantity of albumen is usually minute, and it has little tendency to persist after the resumption of ordinary food."

Pettenkofer's and Voit's observations * convinced these physiologists that albuminuria was never caused solely by excess of nitrogenous food. Voit gave a dog weighing 35 kilogrammes 2,600 grammes of meat

* Quoted by G. Sée, "Du Régime Alimentaire," p. 705.

But, as Dujardin-Beaumetz has well pointed out, in dealing with cases of advanced Bright's disease, it is not so much the quantity of albumen that appears in the urine that should be our chief concern, but rather the extent of the renal changes and the *consequent retention* of products of nitrogenous waste in the system; and it is to avoid or diminish the risks of this *intoxication* with urinary excreta that our dietetic rules should be directed.*

The clear indication, then, is to administer such food as is found to be readily assimilable, and which will least tax the digestive functions, and at the same time furnish the smallest amount of nitrogenous waste calling for elimination by the damaged kidneys.

To fulfil this indication it has been proposed to restrict the food of those suffering from both acute and chronic Bright's disease, *exclusively* or almost exclusively to *milk;* and it is certain that some of the most remarkable and best results in the treatment of these cases have been obtained from a strict adherence to milk diet—the *régime lacté* of French authors. In cases in which this plan of feeding has been well borne, it has been observed that the flow of urine has increased, the excretion of albumen diminished, the amount of urea and extractives has been augmented, and the anasarca has disappeared.

But great practical difficulties are often encountered in procuring the adoption of this method by the patients themselves, and in not a few cases a diet consisting exclusively, or even largely, of milk is not well tolerated.

It is, however, quite established that an exclusively milk diet can completely supply all that is needed to repair the nutritive wants of the organism.

As a food for adults milk is defective in the

* "L'Hygiène Alimentaire," p. 188.

stomach shows less tolerance of the change, it should be made more gradually, and half a glass or a glass of milk should be taken at suitable intervals, and other kinds of food slowly and by degrees replaced by it.

The milk should be as fresh from the cow as it is possible to obtain it, and drunk at the ordinary temperature, not boiled, and with no flavouring or addition whatever. It is better to take it in small or moderate quantities at short intervals—a glass (6 oz.) every hour during the day, and two glasses on getting up and on going to bed; or when it is inconvenient to take it so often, two glasses may be taken every two hours. When the patient is restricted entirely to milk, it must be remembered that he will require to take from 18 to 24 glasses of 6 oz. each in the twenty-four hours.

It is very important that at the commencement of this diet the doses should be small; dislike of the remedy and digestive troubles are much more likely to occur and interfere with the success of the treatment if the patient is allowed to begin by taking large quantities at a time.

If diarrhœa should occur, it is a sign that the milk is not digested, and the diet must be altered or modified; a reduction in the quantity may be all that is needed.

As soon as the tolerance of this milk diet is established and the patient is able to take from five to seven pints a day, an inconvenience arises in the form of obstinate constipation; and, at the same time, the patient often complains of an unpleasant taste in the mouth and a dirty tongue.

The state of the mouth may be improved by sipping a little soda- or seltzer-water after each glass of milk; and the constipation must be encountered by some suitable aperient—a little Gregory's powder or

of the albuminuria, and we may slowly and gradually return to the ordinary diet.

In *chronic parenchymatous nephritis* (inflammation of the tubules), the result of treatment will depend upon the age of the patient and the duration and extent of the kidney lesions.

In advanced cases, where cure is not possible, considerable amelioration in the general condition of the patient may constantly be observed, together with an increased flow of urine, disappearance of dropsy, a steady diminution, little by little, of the amount of albumen, which, although it may not entirely disappear, at the end of six or eight weeks, will be reduced to a minimum. The kidney lesions are irreparable, but the milk diet has lessened, in a great measure, the excretion of albumen, and has restored a due elimination of the nitrogenous and other urinary excreta.

In cases of *cirrhotic* or *interstitial nephritis* (gouty contracted kidney), an exclusively milk diet is less urgently indicated. When, however, the cardiac compensation begins to fail, and symptoms of uræmia are threatening, then great advantage may follow the adoption of this mode of treatment.

We are in ignorance at present as to the precise manner in which the milk acts on the organism or on the diseased kidneys so as to produce the beneficial results observed.

In those cases in which an exclusively milk diet is badly borne or absolutely rejected by the patient, we must fall back on some other method of feeding.

We should, in the first place, endeavour to induce the patient to accept a modified milk diet, and supply him with dishes largely composed of milk, but which have the advantage of agreeable flavouring, without which food of all kinds is so repugnant to many.

which seem to be passing from acute to chronic, and before the structure of the kidneys has been hopelessly damaged by inflammatory and degenerative changes—it is in such cases as these that the exclusively milk diet is attended with such brilliant results.

In those cases in which, for some reason or other, the milk diet is inadmissible, we have to consider what is the best alternative.

It has already been pointed out that the subjects of albuminuria must carefully avoid any *excess* of nitrogenous food. Senator recommends that animal flesh should be altogether avoided, or limited to, at most, a little white meat, while all kinds of vegetables and fats are permissible. Dujardin-Beaumetz also testifies that he has obtained excellent results by restricting patients with albuminuria to vegetable food. Farinaceous food, fresh vegetables, and fruit, together with milk, butter, cream, and other fats, afford all that can be needed for the nutrition of the body.

Dujardin-Beaumetz commends the onion, especially, as an addition to soups; and he states that when he has found his albuminuria patients unwilling to relinquish meat, pork has appeared to him to increase the amount of albumen excreted less than other meats, and he is, therefore, in the habit of recommending them either ham or cold roast pork, and the fat in particular. He differs from Senator in not thinking well of *fish* in these cases; he believes it increases notably the amount of albumen in the urine. As cheese is a highly albuminous food it should be avoided altogether, or taken only in very small quantity.

As a beverage, he prefers milk, so long as the patient can tolerate it; all spirits and undiluted wines, and all kinds of beer, he forbids entirely; he allows, in certain cases, a small quantity of wine, especially tannin wine (St. Raphael), mixed with the weaker alkaline waters of Vals or Vichy.

Semmola of Naples has advocated the habitual use of the following drink for patients with Bright's disease :—

Sodium iodide	. . . .	15 grains.
,, phosphate	. . . .	30 ,,
,, chloride	. . . .	90 ,,
Drinking water	. . . .	36 oz.

He recommends that this should be drunk daily, either alone or mixed with milk, and states that he has obtained the best effects from its use.

CHAPTER V.

DIET IN GOUT AND CALCULOUS DISORDERS.

If gout is, as we have maintained elsewhere,* mainly due to disturbed retrograde metamorphosis of the nitrogenous constituents of food, it follows that it must be a disease greatly under the control and influence of diet.

Closely related to those morbid disturbances in the metabolism of nitrogenous food which give rise to the well-known manifestations of gout, are certain states of the blood and other fluids, which, owing to the abnormal amount or insoluble nature of the excrementitious solids contained in them, or to some other morbid, physical, or chemical change in these fluids, tend to deposit some of their solid constituents *within* the body. In the more common forms of gout this tendency is shown in the deposition of insoluble urates in and around joints. In what are termed gravel and calculous disorders we find solid deposits occurring in the urinary passages; and in this connection we may also consider the analogous deposits which occur in the biliary tracts.

From a dietetic point of view we shall find it convenient to consider these related conditions together, as they are capable of being influenced and controlled by much the same dietetic rules.

Too much stress has been laid on insufficient bodily exercise as a principal cause of the conditions adverted to, when associated with too liberal an animal dietary; for a careful examination of the habits of life of those who suffer from these affections will lead to the discovery that very many are persons of exceedingly

* "The Therapeutics of the Uric and Diathesis."—*British Medical Journal*, January 7th and 14th, 1888.

It is also necessary to bear in mind at the outset that gout is a general, constitutional, chronic malady, and that the attacks of acute arthritis so commonly regarded as the characteristic manifestations of gout may be entirely absent, and, even when present, may constitute by no means the most serious part of the morbid phenomena with which the gouty person is afflicted.

We must also, and more especially, look to disturbances in the assimilative functions, to disorders of digestion, stomachic and intestinal, to functional derangements of the circulatory and nervous systems, to changes in the coats of the superficial arteries, and particularly to the physical and chemical characters of the urine, as presenting important indications of the existence of the gouty state—*i.e.* of the presence of uricæmia, or other allied morbid states of the blood, calling for dietetic treatment.

If we accustom ourselves to look at gout with this wider and more general conception of its nature in our minds, we shall not fail to recognise its influential presence in connection with many vague morbid states often greatly misunderstood.

You will find in young children,* in the nursery even, but more commonly at school, who happen to be the offspring of intensely gouty parents, severe headaches, troublesome neuralgias, chronic skin affections, attacks of asthma, and various other disturbances of health connected with the inheritance of the gouty constitution, and dependent on morbid states of the blood which are capable of being modified and ameliorated by diet.

In women, and not only those who have passed the climacteric, but also in young women—although,

* G. Sée has stated that out of 200 gouty patients he found 30 per cent. under 20 years of age. "Du Régime Alimentaire," p. 429.

taken in great excess they cannot be completely oxidised into urea, which is very soluble and readily eliminated; consequently, an abnormally large proportion is converted into uric acid, representing a lower grade of oxidation; and the salts of this acid, being very insoluble, are less readily eliminated, and therefore tend to accumulate in the blood and to be deposited in the body.

This view, of course, traces gout to an excess of nitrogenous ingesta. But if we refer gout to a deficient alkalinity and diminished solvent power of the fluids, however brought about, we get a wider, and perhaps a truer, grasp of the causation of the disease; for while this view recognises the causative influence of an excess of albuminates in the food, it does not exclude other causes, which we must take into consideration in explaining the occurrence of this disease in many persons.

It has been noticed (Voit and Hoffmann) that strongly acid urines show a tendency to deposit sediments, and it has been pointed out that in the metabolism of albumen, the sulphur and phosphorus contained in it become converted into sulphuric and phosphoric acids, all of which may not be completely neutralised, and may be sufficiently in excess to augment the acidity of the urine; so that an excess of albuminous food may contribute to the deposition of insoluble salts of uric acid by diminishing the alkalinity of the fluids, which, indeed, it is known to do. In the same way, those dyspeptic conditions, which are so common in some gouty persons who are not large feeders, may tend to an increased formation of the organic acids, and so to a reduction in the alkalinity of the blood, and thus bring about *uricæmia* —*i.e.* a retention of uric acid in the blood.

Thus we already see that one of the most important dietetic indications in the treatment of the

freely, and therefore, as a rule, secrete a concentrated urine liable to yield deposits, we should also adopt other means to prevent the accumulation of fat.

G. Sée also insists especially on the prejudicial effects upon the gouty of a diet rich in nitrogenous food when *combined* with sugar, gelatin, and fats.

Ebstein, however, advocates the consumption of a moderate amount of fat, so as to diminish the quantity of carbo-hydrates needed, as he regards these as the most fattening of all foods. He also considers fat useful as quickly satisfying the appetite and diminishing the desire for food.

We see no reason for withholding a moderate amount of fatty foods from gouty persons who show signs of defective nutrition, provided they digest them without difficulty; but, on the other hand, we should restrict them as much as possible in the diet of the corpulent and well-nourished.

It is a grave error to impose on the gouty a too rigorous abstinence. Their diet must contain all that is needed for the due nutrition of the body and for maintaining its functional activity. It must, therefore, be proportioned, in some measure, to the work and activities of individual organisms. But it is a wise precaution at all times to draw the supplies of food, so far as is practicable, from the more readily-digested and more nutritious vegetables.

Green vegetables and fresh fruits are especially suitable, as they are known to render the urine more alkaline, while they do not favour the deposit of fat in the body; but an exclusively vegetable diet is by no means to be commended, save in quite exceptional instances.

The feeble digestion of many gouty persons is unequal to appropriating that comparatively *large mass* of vegetable food which is necessary to supply the wants of the system, and a certain proportion

green vegetables and salads. Sorrel, tomatoes, and asparagus have, however, been especially prohibited, on the ground that they contain oxalates, and oxalic acid is a congener of uric acid. But we have been recently assured that it is an error to proscribe *tomatoes*, as they contain but a very small amount of oxalic acid; whereas *spinach*, which has been so universally approved of, is, next to sorrel, the richest in this acid.* To asparagus, if eaten without melted butter, we see no practical objection.

Those dry vegetables which are both rich in albuminates as well as in carbo-hydrates, such as haricot and other beans, peas, lentils, should be partaken of only in small quantity. Mushrooms and truffles are prohibited.

Bread, which is also a highly-nitrogenous food, should be taken only in moderation, and is, perhaps, least harmful when well toasted. Bouchardat has proposed to substitute potatoes for it.

Most fresh, ripe fruits are wholesome, and most cooked fruits, as stewed or roasted apples, etc.; but the highly-saccharine fruits, whether fresh or dry, are not so suitable, and should be taken in very moderate quantities.

Next, as to the best beverages for the gouty; and first, as to milk. Some differences of opinion exist with regard to milk; and no doubt there are great individual peculiarities in respect of its digestibility. Some cannot digest it at all, some dislike it excessively, and others can digest it in any quantity and are fond of it. For the latter, we consider that it serves as an admirable form of food, especially if skimmed or diluted, presenting, as it does, all the principles necessary for the nutrition of the body in a form readily assimilated by those with whom it

* Dujardin-Beaumetz, "L'Hygiène Alimentaire," p. 169.

should be largely diluted, either with pure water or with an alkaline effervescing table-water. The value of drinking considerable quantities of hot water has been largely insisted on by many physicians, and we have had occasion to form a favourable opinion of the practice if kept within certain limits.

Strong beers, porter, and stout should be avoided by all gouty persons. We have known a few instances in which stout has been well borne, but a large quantity of alkaline salts was at the same time taken habitually.

Cider, which contains malic acid in combination with potash, has been said by Meissner and Koch to favour the formation of uric acid, and on that account has been prohibited to the gouty. Germain Sée, however, considers cider, especially when sparkling, an excellent diuretic, which favours the expulsion of uric acid gravel; and his opinion is, as we shall see, shared by Sir H. Thompson, who considers it a useful beverage in calculous disorders.

Of wines, all strong, sweet, or spirituous wines should be carefully avoided, such as sweet or strong champagnes, ports, sherries, Madeira, Burgundy, and the stronger clarets. All wines which contain much sugar, alcohol, tannin, or free acid are unsuited to the gouty. Still Moselle, light hock, some of the best Hungarian wines, light, well-kept, fine-quality Bordeaux—all these are permissible in small quantity, diluted with an alkaline table-water, so as to neutralise any free acid they may contain. The more distinctly diuretic the effect of the wine, the better, as a rule, will it agree with the gouty.

With regard to alcoholic beverages in general, it may be said, unhesitatingly, that the gouty persons who can do without them entirely are wise to do so. If they cannot exist comfortably without some small or moderate amount of an alcoholic beverage, then they

Phosphatic urinary deposits are usually secondary to some other morbid state, to the removal of which the dietetic or other treatment must be directed.

The formation of *biliary calculi* is also often found to occur in the gouty, and may doubtless depend on the same causes as uratic deposits, viz. on too great concentration and defective alkalinity of the fluids. The deposition of biliary concretions may depend either on an excess of cholesterin (the chief constituent of gall-stones) in the bile, or on a deficiency in solvent power of the fluid of the bile allowing the cholesterin to be deposited, although it may not be in excess.

The formation of an excess of cholesterin appears to be sometimes dependent on an excessive consumption of fats, or upon exaggerated activity of the nervous functions, cholesterin being looked upon by some as derived from the products of nervous waste.

Its deposition, when the bile is defective in alkalinity, has been demonstrated by Thénard, and this condition of the bile has been traced to a too exclusively animal dietary. Sedentary habits, of course, promote such deposits by favouring the stagnation of bile in the gall-bladder.

Whatever may be the cause, when biliary concretions are known to exist, a most carefully regulated dietary should be insisted upon.

Fatty substances should be entirely, or almost entirely, excluded from the food, as well as sugar.

The quantity of food taken should be strictly within the limits of what is necessary for the due maintenance of the nutrition of the body, and all excess must be strictly forbidden.

Farinaceous substances may be taken in moderation. Peas are regarded by some as unsuitable, as they are said to contain a fatty body analogous to cholesterin.

brewing in England some light infusion of malt and hops like the light *lager* beers of Germany.

Champagne, if sweet, he regards as especially harmful; but we have found a small quantity of dry and sound champagne, mixed with a little Apollinaris water, as well borne as any other wine in these cases.

Bordeaux wines, unless unmistakably pure and sound, as well as of light quality, are to be forbidden, as are all sweet wines, ports, sherries, etc., and all strong beers.

The important point is, that all the beverages should be free from saccharine matters.

As to the kind of food prescribed: it is, in the first place, necessary to ascertain the patient's habits of life, whether they are active or sedentary. Those who lead active lives must be allowed more hydrocarbons and more meat than the sedentary. In advanced age it is of great importance so to limit the dietary that we avoid overtaxing the eliminative organs.

The calculous patient is, in the greater number of cases, too stout, and he should be allowed only a very spare amount of fats. A reduction of weight is a good sign, and it is an undoubted advantage if, by dieting, a loss of four or five pounds of weight in the first month can be effected.

When not corpulent, a less rigid abstinence from fats may be permissible.

The following fat-containing foods must be eschewed, or taken only in very small quantities:—Milk, cream, butter, cheese, eggs (especially omelettes), pastry, fat pork, suet in puddings and pastes, and the fat of roast and boiled meats. Rice or sago puddings, being mixtures of milk, egg, and sugar, Sir Henry Thompson speaks of as "in the last degree objectionable for uric-acid-making, gouty patients," although he admits that they are excellent for children

proportion of about one quarter to one-third of the wheat-meal employed.

Dry haricots and lentils are most nutritious vegetables, and should be taken made into *purées*. They are digested with ease, and contain much nutritious matter.

Rice, *sago*, *tapioca*, and *arrowroot*, are all useful if treated as *savoury* dishes, not as *sweets*.

Fresh green vegetables are especially good.

Fresh green peas and broad beans, *well masticated.*

Light salads are permissible to persons who digest them easily, but they must not be taken by those who digest them with difficulty.

Celery, sea-kale, asparagus, tomatoes, potatoes, and artichokes, are all permitted; so also are *apples*, roasted or baked, without added sugar.

The following are to be avoided:—Rhubarb, gooseberries, currants, strawberries, raspberries, grapes, plums, pears, and all *sweet* fruit, fresh or preserved.

Saccharin may be substituted for sugar.

The following diet, adopted with advantage by a medical man who suffered from gout and gravel, was published in the *Practitioner* :—

7.30 a.m.—Ten oz. of very hot water.

8 a.m.—*Breakfast.*—Equal parts of weak tea and milk, a small quantity of white sugar, a slice of fat bacon without a strip of lean, bread and fresh butter.

1 p.m.—Milk pudding, rice, sago, tapioca, macaroni, a blanc-mange, and small biscuits, with butter.

Ten oz. of hot water.

4 to 5 p.m.—Ten oz. of hot water.

6 p.m.—*Dinner.*—White fish or fowl (usually boiled), greens, bread (*no potatoes*).

Claret, 7 oz.

8 to 9 p.m.—Ten oz. hot water.

11 p.m.—Ten oz. hot water.

In this diet there is a very strict limitation of nitrogenous food, while the elimination of the products of nitrogenous waste is facilitated by the ingestion of considerable quantities of hot water.

If this gentleman "indulges either in meat or game, or drinks copiously of claret, or omits one or

CHAPTER VI.

THE DIETETIC TREATMENT OF OBESITY.

VARIOUS dietetic methods have been advocated for the cure of obesity, but they have, nearly all of them, had the same end in view, viz. the reduction of the total amount of food taken. In a very large proportion, if not in all, of the cases of excessive corpulence a reduction in the *quantity* of food taken is the essential condition of its cure; and that reduction must be sufficient to remove all excess of fat-forming food (and there is scarcely any form of food, as we have seen in previous chapters, from which fat cannot be formed) from the dietary.

Let us take a hypothetical case. A person with a tendency to obesity, who appears to be a very moderate feeder, happens to take, in excess of his wants, half an ounce of sugar daily, which we will assume is converted into and is stored up in his body as fat. This is adequate to a yearly increase in weight of over eleven pounds, or in five years to four stones! Let us then bear this fact in mind in dealing with cases of obesity, that a patient weighing twelve stones may add four stones to his weight in five years, simply by the daily deposition within his body of half an ounce of fat derived from this small daily excess of fat-producing food.

The most common cause of obesity is the excess of food, although in some cases it may be difficult at first to discover in what particular there is excess; for we must also recognise a peculiar constitutional, and often inherited, aptitude for fattening—observed also in many animals—which leads to the development of obesity from an almost inappreciable excess of food or drink.

the neglect of this consideration that so many instances of undue corpulency are attributable in advancing life. The capacity for muscular exertion is also lessened, and there is no longer either the disposition or the ability to engage in those active physical exercises, which in earlier years dispose of much of the surplus food supply, as has been already explained.

There is, however, a certain small or moderate proportion of cases of obesity which appear to arise independently of any excess of food, and to be determined by some morbid state of the system leading to defective oxidation and imperfect combustion of certain elements of the food within the body. To this class must be referred some of the "fat anæmics" alluded to by Dr. Weir Mitchell; the cases of obesity associated occasionally with the hysterical state, and other nervous disorders; as well as the gravest cases of all, viz. those cases in which fatty degeneration of the nitrogenous tissues accompanies the excessive deposition of fat.

These cases must, of course, be carefully differentiated from the ordinary common form of obesity, and their treatment must be determined by other considerations.

Dr. Weir Mitchell suggests that climate may have much to do with the tendency to obesity, and he says the first thing an American in England is struck with is "the number of inordinately fat middle-aged people, and especially of fat women." * But it is very doubtful if England has a greater proportion of very fat people than other European countries, and an American visitor to Carlsbad or Marienbad would probably discover that the fattest people undergoing a cure at these places would be of other than English nationality.

* "Fat and Blood." Fifth edition, p. 21.

Breakfast at 9 a.m. consisted of 5 to 6 oz. of animal food—meat or boiled fish (except pork or veal); a little biscuit, or 1 oz. of dry toast; 6 to 7 oz. of solids in all. A large cup of tea or coffee (without milk or sugar) = 9 oz. of liquid.

Dinner at 2 p.m.—Fish or meat (avoiding salmon, eels, herrings, pork, and veal), 5 to 6 oz., any kind of poultry or game. Any vegetables, except potato, parsnips, beet-root, turnips, or carrot. Dry toast, 1 oz. Cooked fruit, unsweetened. Good claret, sherry, or Madeira, 10 oz. Total of solids, 10 to 12 oz.

Tea, 6 p.m.—Cooked fruit, 2 to 3 oz., a rusk or two ; 2 to 4 oz. of solids. 9 oz. of tea, without milk or sugar.

Supper, 9 p.m.—Meat or fish, as at dinner, 3 to 4 oz. Claret, or sherry and water, 7 oz.

This diet allowed only from 21 to 27 oz. of solids per diem, of which 13 to 16 oz. consisted of animal food, and only 2 oz. of bread; the rest consisted of fruit and fresh vegetables. There was the strictest possible exclusion of starches and sugar.

The total fluid was limited to 35 oz.—*i.e.* about a pint and three-quarters.

With this diet Mr. Banting reduced himself in a year from 14 st. 6 lb. to 11 st. 2 lb.

The *Ebstein* method, which has been largely applied in Germany, differs from the preceding in recognising the possible transformation of albuminates into fat; and Ebstein considers that this transformation is chiefly dependent on the simultaneous free use of carbo-hydrates, but that the consumption of fat has little or no influence in this direction. He recommends the use of fat because it produces a feeling of satiety or satisfaction, and so leads to the consumption of less food; and also, by diminishing thirst, lessens the desire for fluids. Dujardin-Beaumetz points out that Hippocrates anticipated Ebstein in this matter, and he quotes his advice to the obese that they should eat fat on account of its satisfying effects and its influence in lessening the consumption of food. Ebstein maintains that it is precisely owing

bodily exercise is possible; and another—the graver form—in which the muscle of the heart is invaded and weakened, and other functional derangements connected therewith are developed.

Adopting Voit's statement that the human body decreases in fat if the daily food consists of the three great groups of food in the following proportions: Albuminous food, about 4½ oz.; fatty food, about 1⅗ oz.; and carbo-hydrates, about 5⅓ oz., the following comparative table shows the relations of the Banting, Ebstein, and Oertel methods to the above theoretical estimate and to one another:—

	Albuminates.	Fats.	Carbo-hydrates.
Banting . .	6 oz.	⅓ oz.	2¾ oz.
Ebstein . .	3½ oz.	3 oz.	1¾ oz.
Oertel . . .	5½ to 6 oz.	1 to 1¼ oz.	2½ to 3½ oz.

They all agree in reducing largely the carbo-hydrates, so that there is a general consent that these foods greatly contribute to the excessive deposit of fat.

Oertel's formula differs from the Banting formula simply in allowing considerably more fat and slightly more starchy food. It differs greatly from Ebstein's in allowing nearly twice as much albuminous food, less than half as much fat, and about twice as much carbo-hydrates. This amount of fat and carbo-hydrates is admissible in those cases where active exercise can be and is taken, as muscular exertion is attended with a considerable destruction of fat, and the relative excess of albuminous food in this formula leads to the displacement of the fat accumulated in the substance of the muscles, and to a new formation of muscular tissue in its place. At the same time, this diet

heights. The patient should walk slowly uphill until palpitation comes on, when he must stop until he can again breathe easily, but he must not sit down. He must walk several hours a day, and climb as much as possible. He should go upstairs now and then by way of exercise. Of course the capacity for taking exercise will be found to differ in different cases. Too much must not be required, but also not too little.

2. To preserve the normal composition of the blood, the food should be chiefly albuminous. It may consist of the lean of roast or boiled beef, veal, mutton, game, and eggs. Green vegetables, such as cabbage and spinach, may be taken; fat and carbohydrates only in very limited quantities; from 4 to 6 oz. of bread per diem.

3. To regulate the quantity of fluid in the body, the amount of fluid drunk daily must be limited. One cup (rather less than 6 oz.) of coffee, tea, or milk, morning and evening, and about 12 oz. of wine, with from 8 to 16 oz. of water, should comprise all the fluid consumed in twenty-four hours. In the hot season the amount of fluid may be slightly increased, if the case is not one of the graver kind. Beer is entirely forbidden.

The discharge of fluid from the body is promoted by such exercise as has been described; and if this is not possible, a course of baths with packing should be taken several times in the year. Each course should last four or five weeks, and the baths should be taken about twice a week.

4. To prevent the deposit of fat, the principles of diet already set forth must be carried into practice as follows:—

Morning.—One cup of coffee or tea, with a little milk, altogether about 6 oz. Bread, about 3 oz.

Noon.—3 to 4 oz. of soup, 7 to 8 oz. of roast or boiled beef,

7 p.m.—A small quantity of bread and cheese.
9 p.m.—Cold meat, eggs, salad. Two glasses of wine, and sometimes more.

Germain Sée protests against the limitation of beverages in some of the foregoing systems. He maintains, on the contrary, that an abundance of water is most useful. "I have been able," he says, "to treat and to cure a great number of cases by a *régime* of albuminates and fats, together with a *great quantity of drink,* especially of warm aromatic drinks." * Hot tea is the beverage he especially favours. Water, he urges, aids digestion by its solvent power, stimulates organic changes in the tissues, and promotes the elimination of waste material. The strict limitation of water, he points out, must be very injurious in those gouty constitutions with a tendency to uric acid deposits, which so often show a disposition to corpulency. "The most useful beverages," he says, "are infusions of tea and coffee; and the preference should be given to tea, taken at breakfast in considerable quantity and at a high temperature. All obese persons who take this beverage habitually at or between their meals obtain better results than from pure water, even taken cold."

Alcoholic drinks he strictly forbids on account of their well-known tendency to favour fatty degeneration. A little wine and water is the most he permits.

He approves of Ebstein's system, with the modification here indicated, and reports excellent results from its application. He has, however, observed some difficulty in digesting the fats, and some dyspepsia provoked in certain instances.

Weir Mitchell † advocates "rest, milk dietetics, and massage in people who are merely cumbrously

* "Du Régime Alimentaire. Régime des Obèses."
† "Fat and Blood," pp. 104-106.

annoyance, and with no obvious result except a gain in health and comfort."

The great difficulty in applying this method lies in the enforced rest in bed for a week or two which it requires, and which few men engaged in any kind of occupation would be willing to adopt. It is more applicable to women without serious occupation.

In reviewing these various dietetic methods of treating obesity it will be seen, as we have already pointed out, that they all aim at reducing the average quantity of food taken. If we compare the normal average daily ration with that permitted in these methods, this fact becomes very evident:—

	Albuminates.	Fats.	Carbo-hydrates.
Normal average (grammes)*	130	84	404
Banting	170	10	80
Ebstein	100	85	50
Oertel	155–179	25–40	70–110

The carbo-hydrates are especially attacked in all these methods, and very largely reduced. There would seem to be a far greater tendency to excess in this class of food than in the other classes. In two of these methods there is an excess of albuminates; this excess has been considered to favour the reduction of obesity by promoting the oxidation and combustion of the excess of deposited fat. This view of the effect of an excess of albuminates has been carried to an extreme in a method recently introduced from America, and sometimes spoken of as the "Salisbury" method. It is usual in this method to restrict the diet absolutely for a time to large quantities of rump-steak,

* Moleschott's.

as pointed out by G. Sée, are better for the free use of hot, diluent drinks, and these are, especially, the gouty cases with a tendency to defective elimination. It is in such cases that a teacupful of hot water taken half an hour before each meal and at bed-time answers well, and enables them to do with much less fluid at meal-times than is usually taken.

The two principal objects of all these methods is, *first*, to make the corpulent person consume the excess of fat deposited in his body by restricting the food-supply, or augmenting its combustion by increased physical exercise or other means; and, *second*, to establish a dietary which shall prevent its re-accumulation.

None of the methods described is appropriate to the treatment of all cases of obesity indiscriminately, while any one of them may prove successful in suitable instances.

In conclusion, the following is the method which we recommend to be generally adopted: a very careful examination should be made of each case in order to ascertain the presence or absence of any organic disease, especially of any cardiac degeneration, and if we are satisfied that the obesity is not secondary to any other morbid state, or associated with any general degeneration of organs, we may proceed with confidence to prescribe an appropriate *régime*.

The albuminates in the form of animal food should be strictly limited. Farinaceous and all starchy foods should be reduced to a minimum. Sugar should be entirely prohibited. A moderate amount of fats, for the reasons given by Ebstein, should be allowed.

Only a small quantity of fluid should be permitted at meals; but enough should be allowed to aid in the solution and digestion of the food.

Hot water, or warm aromatic beverages, may be

CHAPTER VII.

DIET IN ANÆMIA, CHLOROSIS, NEURASTHENIA, AND ALLIED DISTURBANCES OF NUTRITION.

THE due and adequate nutrition of all the organs and tissues of the body, and their maintenance in a stable state of normal functional activity are essentially dependent upon the integrity of the circulating fluid, the blood, which brings to each of them the elements necessary for the support of their structure and the development of their functional energies. Any defect in, or deviation from, the normal composition of the blood will, therefore, tend to disturbance and deterioration in the condition and functions of all the organs of the body; and it is obvious, and needs no demonstration, that the reception, digestion, and assimilation of a sufficient quantity of suitable food are requisite to maintain the needful healthy quality and quantity of the blood, and to restore them when lost.

It is clear, then, that the morbid states of the blood known as anæmia and chlorosis cannot be successfully remedied without due attention to diet.

Those troublesome states of disturbed health and nutrition, commonly described as cases of neurasthenia or nervous exhaustion, are generally associated with an anæmic condition, and their dietetic treatment may be conveniently considered in this chapter.

In some of the latter morbid affections it seems not unlikely that the defective nutrition observed in them may be, in part, due to original disturbances in the functional activity of the cellular elements brought about, directly or indirectly, by nervous influences, and that the altered condition of the circulating fluid which ensues may be referred, primarily, to some disorder of the nervous system; hence, no doubt, the

wholesome and needful activity require a certain repose of the nervous system, which is inconsistent with severe mental tasks.

The more acute forms of anæmia may be caused by hæmorrhages, or be the result of severe illnesses, and in the latter case considerable emaciation generally accompanies it.

With suitable food recovery is very rapid in most of these cases, and a moderate loss of blood is soon made up; the fluid part is, however, more quickly restored than the corpuscles.

In some chlorotic females it has been said that the heart and blood-vessels are abnormally small, so that they suffer from a congenital weakness in the blood-forming and blood-propelling apparatus; in such instances, not only must great care be observed in the regulation of the diet, but all the organs of the body should be safeguarded from undue strain or any over-exertion.

In all cases of anæmia not only must we see that the supply of food is adequate and its quality suitable, but we must also watch over its digestion and assimilation. The functional disturbances which are associated with poor and watery blood are especially marked in the digestive organs, the secretions of which become defective both in quantity and quality, and dyspeptic troubles are, therefore, common accompaniments of the anæmic state. Disturbances of the nervous system from an imperfect blood-supply are likewise frequent, such as languor, depression of spirits, giddiness, headache, neuralgia, etc.; while the whole muscular system is enfeebled from defective nutrition, so that muscular fatigue and aching of the muscles are often induced by comparatively slight exertion; and in no muscle is this more evident, or distressing, than in the heart muscle, which shows its distress by palpitation on the slightest exertion, by a

[illegible]

[illegible] dietetic

[illegible] Chirurgiques [illegible]

1. The food should contain the elements needed for the restoration of the deficient blood corpuscles, and the general normal integrity of the circulating fluid.
2. It should be directed to restoring tone to the enfeebled muscles, and especially to the cardiac muscle.
3. It should be supporting and soothing to the exhausted and irritable nervous system.
4. It should be of a kind, and in a mode of preparation, which renders it easily and quickly appropriated by the organs of digestion and assimilation—processes especially languid and feeble.

At the outset of the treatment, *rest* of the exhausted organism should be particularly enforced. The tendency to urge the young who are feeble and anæmic to take abundant exercise, and to make them follow the same mode of life as their healthy associates, cannot be too strongly condemned. It interferes with the success of all our remedial measures. To insist, as is so often done, that a chlorotic young girl shall rise at the same hour in the morning as the rest of the family, partake of the same meals at the same hours, engage in the same pursuits, and conduct herself as if she were strong and well, is most unreasonable and harmful.

Instead of such a routine, she should be given her breakfast in bed; she should not be allowed to rise much before mid-day; she should be encouraged to rest as much as possible, in the recumbent position, in an airy apartment, or be swung in a hammock during fine weather in the open air. As soon as some improvement in the blood condition is observable, and some return of healthy functional activity is apparent, a moderate amount of gentle exercise may

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Peptonised milk—a breakfastcupful twice or three times a day—will be useful when unprepared milk disagrees.

To obviate the tendency to constipation, well-made whole meal bread may be given, watching again carefully for any signs of indigestion which it is apt occasionally to provoke. For the same purpose, oatmeal porridge may be taken at breakfast, and some fruit *compôte.*

Green, fresh vegetables, especially in the form of *purées*, are also to be recommended for the same purpose. Macaroni, vermicelli, polenta, and the various Italian pastes, cooked with meat-juice or gravy, are excellent.

Animal albuminates should predominate in the diet at first, given in quantity proportionate to the digestive capacities. Some easily-digested fat—particularly in cases where there has been loss of flesh—should soon be added; indeed, progress in blood-making will often fail to take place until some digestible fat be added to the dietary. A dessertspoonful of cod-liver oil once a day will frequently suffice, and should be ordered when it is not objected to. When this is objected to, some other form of fat should be introduced into the daily dietary.

Butter is one of the best; so is cream. They may be agreeably mixed with some farinaceous food in the form of light puddings, and served with fruit-sauce or jelly. Broiled fat bacon at breakfast is, with many persons, an easily-digested form of fat.

Eggs in any form, especially the yolks, are a very suitable food, as they present a concentrated and generally easily-digested form of nutriment rich in iron. The yolks of one or two eggs, beaten up with a little boiling water, with or without milk, to which a little sugar, nutmeg, or other spice, and a table-spoonful of brandy may be added, are an excellent and

vinegar, as causing "a high degree of anæmia and emaciation, since the acid lessens the alkalinity of the blood and the number of the blood corpuscles," has already been quoted.

For the appropriate dietetic and other management of those cases of *neurasthenia* or nervous exhaustion, in which the general nutrition is so gravely affected that quite phenomenal states of emaciation and muscular feebleness are observed in connection therewith, we are mainly indebted to Dr. Weir Mitchell. These cases cannot, however, be restored to health by appropriate food alone, but other curative agencies have to be simultaneously and systematically employed. These are complete isolation, rest in bed, and the regular application of massage and electricity. To use Weir Mitchell's own words, the method consists of "a combination of entire rest and of excessive feeding, made possible by passive exercise obtained through the steady use of massage and electricity."* He insists on the intimate association between the gain and loss of fat and the gain and loss of blood corpuscles. "The loss of fat . . . nearly always goes along with conditions which impoverish the blood; and, on the other hand, the gain of fat, up to a certain point, seems to go hand in hand with a rise in all other essentials of health, and notably with an improvement in the colour and amount of the red corpuscles. . . . To gain in fat is nearly always to gain in blood." It may also be well to let Dr. Weir Mitchell himself describe the cases to which he considers his method especially applicable. They are "people who are kept meagre, and often also anæmic, by constant dyspepsia in its varied forms, or by those defects in assimilative processes which, while more obscure, are

* "Fat and Blood. An Essay on the Treatment of certain forms of Neurasthenia and Hysteria." Fifth edition (1888).

in place of water, and two to four ounces of fluid Malt Extract before each meal.

"No troublesome symptoms usually result from this full feeding, and the patient may be made to eat more largely by being fed by her attendant. I like to give butter largely, and have little trouble in getting this most wholesome of fats taken in large amounts. A cup of cocoa or of coffee with milk on waking in the morning is a good preparation for the fatigue of the toilet. At the close of the 1st week I like to add 1 lb. of beef, in the form of raw soup. This is made by chopping-up 1 lb. of raw beef, and placing it in a bottle with one pint of water and five drops of strong hydrochloric acid. This mixture stands in ice all night, and in the morning the bottle is set in a pan of water at 110° Fahr., and kept two hours at about this temperature. It is then thrown on to a stout cloth, and strained until the mass which remains is nearly dry. The filtrate is given in three portions daily. If the raw taste prove very objectionable, the beef to be used is quickly roasted on one side, and then the process is completed in the manner above described. The soup thus made is for the most part raw, but has also the flavour of cooked meat.

"In difficult cases I sometimes add, at the third week, ½ oz. of cod-liver oil, half an hour after each meal. If it lessen appetite, or cause nausea, I employ it thrice a day as a rectal injection, and in cases where the large doses of iron used cause intense constipation, I find the use of cod-liver oil enemata doubly valuable, by acting as a nutriment, and by disposing the bowels to act daily. When given thus, I like to use it in an emulsion made with the juice drained off, after crushing the fresh pancreas of the beef in warm water. Enough of water to cover ½ lb. of chopped pancreas is allowed to stand for an hour in a warm kitchen, and then squeezed through a towel. An ounce is mixed with half that amount of oil and injected slowly thrice a day." (*Weir Mitchell.*)

As to stimulants, when there is no question of breaking off the alcoholic habit, a small amount of stimulant has been found to assist in the rapid increase of fat; such as an ounce of whisky daily in milk, or a glass of dry champagne, or Burgundy, or other red wine. It increases the capacity to take food at meals. Alcohol, however, is not essential.

With the administration of *solid* food, iron is

she liked, with 6 oz. of Burgundy or dry champagne, and at the end one or two tumblers of milk. 4 p.m., soup. 7 p.m., malt, iron, bread and butter, usually some fruit, and commonly 2 glasses of milk. 9 p.m., soup. 10 p.m., aloetic pill.

(At 12 noon, *massage* for an hour. At 4.30 p.m., electricity applied for an hour.)

At 6th week soup and wine were dropped, iron lessened one half, massage and electricity only on alternate days. $\frac{1}{30}$th of a grain of sulphate of strychnia thrice a day at meals (continued for several months).

At 9th week, milk reduced to a quart. All mechanical treatment ceased.

Result.—Gain in flesh about face in 2nd week. Weight rose in two months from 96 to 136 lb.; gain in colour equally marked. At 30th day patient had normal catamenial flow, after 5 years of failure to menstruate. At 9th week, drove out. Cure complete and permanent.

CASE 2.—(DR. PLAYFAIR.)

A. B., age 32. Rest in bed, isolation.

1st day.—22 oz. of milk, in divided doses.

2nd day.—50 oz. of milk, in divided doses.

3rd day.—50 oz. of milk, in divided doses. (Massage, ½ an hour.)

4th day.—50 oz. of milk, in divided doses; egg and bread and butter; dialysed iron, 40 minims, in 2 doses. (Massage, 1½ hour.)

6th day.—50 oz. of milk, in divided doses; mutton chop. (Massage, 1 hour 50 minutes.)

8th day.—50 oz. of milk in divided doses; mutton chop; porridge, and a gill of cream; maltine twice daily.

(Massage, 3 hours; electricity, ½ an hour; continued to end of treatment.)

15th day.—Three full meals daily of fish, meat, vegetables, cream, and fruit; 2 quarts of milk, and 2 glasses of Burgundy.

22nd day.—Amount of food lessened.

Result.—On 22nd day sat in a chair for an hour, after a month walked down stairs and went out for a drive. "Enormous increase in size." Cure complete and permanent.

Result.—A gain of over 15 lb. in weight, cough gone, became and remained strong and well.

This method, as adopted by Leyden, is thus described by Germain Sée:—

At 7 a.m.—Half a litre of milk, slowly sipped in ½ an hour, a small cup of coffee with cream, 80 grammes (nearly 3 oz.) of cold meat, a plate of fried potatoes.
10 a.m.—A litre of milk, with 3 biscuits.
12 noon.—The same.
1 p.m.—Broth, 200 grammes (about 7 oz.) of fowl, *purée* of potatoes, green vegetables, 120 grammes (about 4 oz.) of *compôte* and pastry.
3.30, 5.30, 8, and 9.30 p.m.—Half a litre of milk, making a daily consumption of 3½ litres of milk.
In the after part of the day, two meals each of 80 grammes (3 oz.) of roast meat, with bread and 3 biscuits.

The class of *fat* anæmic people—mostly women—are alluded to by Dr. Weir Mitchell as of the "utmost clinical interest." They are rare, as he remarks, and must be dependent on conditions not common to all anæmics. The cases that we have seen have been apparently traceable to long-continued faults of diet, especially to the avoidance of nitrogenous food and the consumption of a vastly-increased proportion of carbo-hydrates.

One of the most remarkable cases of this kind we ever observed was in a patient who had a perfect mania for pastrycooks' sweets. She spent large sums of money habitually at the pastrycooks'; and when any impediment was put in her way, she would succeed, by all sorts of ingenious contrivances, in getting her usual supply of sweets. This enormous consumption of carbo-hydrates in combination with fat (as in pastry) was, of course, associated with entire indifference to animal food.

"Obesity with thin blood" is certainly, as Dr. Weir Mitchell maintains, a "most unmanageable

CHAPTER VIII.

FOOD IN SCROFULA, CONSUMPTION, AND CHRONIC FEBRILE CONDITIONS—FORCED FEEDING (SURALIMENTATION).

THE close pathological relationship, if not identity, between scrofula and consumption makes it appropriate to discuss their dietetic management together.

Consumption is also the type of chronic febrile disorders, and the progressive emaciation, which is its characteristic feature, and from which it derives its name, is chiefly dependent on the presence in the great majority, or, at some time or other, in *all* cases, of more or less fever. It is the progressive destruction or consumption of the tissues caused by this chronic fever that we are called upon to antagonise or compensate for by appropriate food. And the dietetic measures which are expedient and useful to check the wasting of consumptives are applicable also to other cases in which a chronic pyrexial state is present.

When a child shows the well-known signs of a *scrofulous* constitution, or when he is known to inherit a tendency thereto, it becomes a matter of great importance that he should be well and carefully fed. It is not, however, necessary to repeat here what has already been said in the section on Food in Infancy and Childhood: the principles of wholesome feeding during this period and the means of carrying them out have been there fully dwelt on. There can be no doubt that an insufficient or inappropriate diet in the early years of life predisposes to the development of scrofula, not only in those who have a hereditary tendency thereto, but in others also. A poor, coarse, innutritious vegetable dietary, involving much digestive

the digestion, and to at once modify the diet if it is found to be attended with signs of dyspepsia.

In scrofulous children of the fat and flabby type it is not so important to administer fatty foods. It is better in such cases to give a diet rich in albuminates, but small in bulk.

The common error is to keep such children too exclusively on farinaceous food, and to give them a very insufficient supply of animal food. In children with very delicate digestions it is often difficult to get them to take fats or oils of any kind. In such cases inunction with oil—cod-liver oil or olive oil—after washing the surface with hot water and soap, is a good plan. All these cases require also an abundance of respiratory food, an abundance of active oxygen, which they should be allowed to obtain by a life in the open air—in the country or by the sea.

In cases of a disease like *pulmonary consumption*, attended with a chronic febrile condition, and consequent continuous loss of weight, unless this progressive wasting is counterbalanced by the supply and annexation of an adequate amount of food, the patient must, in course of time, succumb to the disease. But not only is it necessary in such cases to arrest the loss of weight, we must also strive to so improve the nutrition that the body may *gain* in weight; for it is well known that if we are able to establish an improved state of nutrition, the disease itself becomes favourably influenced thereby. Our success in this effort will depend much on the amount and type of the febrile state which accompanies the malady. When there are distinct intermissions or remissions in the febrile movement, and when this is quite moderate, we may succeed in procuring the assimilation of a considerable quantity of food, provided great care and discretion be employed in its

require mineral food in the same way as plants and animals do, and if we knew exactly which mineral substances the tubercle bacillus requires, and could without harm to ourselves deprive our blood, and cells, and tissues of the salts, by abstaining from food containing them, we should deprive the bacillus of the means of existence." * The difficulties attending such an investigation are, of course, very great. A hint in the right direction may possibly be gained from the fact "that the food of carnivorous animals contains a larger quantity of soda and smaller of potash than that of herbivorous animals, and carnivorous animals are on the whole less subject to tuberculosis than herbivorous animals. If it could be proved that the potash salts are more conducive to the growth of tubercle bacillus than soda salts, articles of food containing excessive proportions of potash ought to be taken only sparingly" (page 48). G. Sée also suggests that the use of cod-liver oil may produce a condition of the tissues hostile to the propagation of the tubercle bacillus; this may be due, he thinks, to the oil appropriating some of the oxygen required for the active multiplication of the micro-organism. "The oil then acts as a protective agent to *our* organism, it acts as a destructive agent to the micro-organisms; our waste is lessened, which is useful; the nutrition of the bacillus is interfered with, which is still more useful." †

Phthisical patients, whose digestive functions are unimpaired, may be allowed to partake of the various nourishing forms of food that enter into the ordinary dietary of the healthy, in addition to which two or three glasses of milk should be taken at convenient intervals between meals, and one of these glasses of milk should be taken the last thing at night, or

* "Croonian Lectures," p. 47.

† "Régime des Phthisiques. Du Régime Alimentaire," p. 400.

the milk perfectly fresh, but that they may breathe the atmosphere of the stables for a short period two or three times a day. He says he is very sure that this atmosphere has the effect of allaying bronchial and laryngeal irritations, and of relieving cough.

He also considers that the addition of some form of alcohol (brandy, rum, or kirsch) presents the double advantage of being useful in itself and promoting the digestibility of the milk.

Germain Sée considers the peculiar value of milk in phthisis to depend upon the fat it contains, and he argues that when enough milk is taken to provide the requisite amount of the other elements necessary for the nutrition of the body, the fatty constituents are in large excess, and this he regards as its great recommendation. For an exclusively milk diet, he estimates the necessary quantity at three litres daily (105 ounces), rather more than five imperial pints.

In many summer health-resorts * in Switzerland and Germany provision is made for following a "milk or whey cure," and in most of these sheep's, goat's, and ass's milk, as well as cow's, milk can be procured. There is no reason, however, for believing that goat's milk is more digestible than cow's milk; but, in the case of diarrhœa, it is thought to be preferable on account of the lime salts it contains. Ass's milk, however, like mare's milk, can often be taken when cow's milk has proved indigestible.

Some of the older physicians, who highly prized ass's milk in the treatment of phthisis, took great pains in seeing to the feeding of the animals that yielded the milk—pains which we may well believe were not wholly wasted; † more recently Latour added

* See my work on "Climate and Health-Resorts." (New Edition.)

† *Vide* Fonssagrives, "Thérapeutique de la Phthisie Pulmonaire," p. 235.

cannot overcome their dislike to it as a beverage. When it is well borne, it is found to be easy of digestion, often relieving dyspepsia and vomiting, and producing increase of weight. It is appropriate to febrile cases, as it quenches thirst, and can often be retained in the stomach when all other food is rejected; indeed, its especial value is in those cases of inveterate dyspepsia and gastric irritability in which all attempts at giving other kinds of food have failed. *Galazyme* and *kéfir*, employed for the same purpose as koumiss, have been already described.

The utility of fatty substances in phthisis is undoubted, and in those cases in which we encounter an insuperable difficulty in procuring the acceptance or the digestion of cod-liver oil, we may encourage our patients to consume as much fresh *butter* and good *cream* as they can digest.

Excellent results have been obtained, even in some advanced cases, from the administration of cream. We have already mentioned a suitable mode of giving it. Some order a little rum or brandy to be mixed with it. The addition of sugar or salt is said to aid its digestion; or it may be mixed with a little tea or coffee, when these beverages do not disagree.

Cocoa and *chocolate* are useful forms of food, and contain a notable quantity of fat. Savory and Moore's peptonised cocoa and milk is very useful. Cocoa, as a beverage, is more digestible when made with water than when made with milk.

Pancreatic Emulsion will be found of service in many cases where there is difficulty in tolerating other forms of fatty food.

Of the various forms of animal food, well-cooked beef, mutton, chicken, and game; clear turtle soup; oysters; many kinds of fish—soles, whiting, turbot, cod, herrings, flounders, smelts, brill—are all suitable to vary the diet of the phthisical.

killed is more sensational and whimsical than rational and efficacious.

In some parts of Germany the roes of salted herrings, and in France several species of snails, are thought to be especially useful as food for the phthisical.

The different kinds of farinaceous foods are all useful and appropriate articles of diet. Wholemeal or well-made brown bread is, on account of the phosphates contained in it, better suited to young consumptives, if they digest it well, than white bread. Lentil-flour is also valuable, as it contains notable proportions of phosphates and iron. Oatmeal is rich in fatty matters, and the flour of maize is still richer—a fact which renders them both very suitable additions to the diet of the tuberculous.

Malt Extract is now largely employed as an addition to farinaceous food, the digestion and assimilation of which the *diastase* contained in it doubtless facilitates.

It is possible also to procure malt bread and malt biscuits.

With regard to the use of *alcoholic beverages*, much difference of opinion exists.

Some advocate the consumption of large quantities of alcohol in phthisis. Flint* quotes cases which appear to have been benefited by the consumption of as much as a pint of whisky daily! We shall find, practically, that the use and need of alcohol vary greatly in different individuals.

In some it diminishes appetite and retards digestion; in others it promotes both; and we shall encounter very few cases of phthisis which are not benefited, at some period of their course, by the discreet administration of alcoholic stimulants.

Germain Sée deduces from experimental data the

* In his work on "Phthisis."

What is termed by the French physicians "*alimentation forcée*"—*i.e.* forced feeding—is an expedient suggested by Dr. Débove of Paris for introducing food in large quantities into the stomachs of phthisical patients who have lost all appetite, or even acquired a positive repugnance for food.

Débove also maintains that his method of artificial alimentation, with or without a previous washing out of the stomach ("*lavage de l'estomac*"), with iced water, is a most efficacious measure for arresting the vomiting of phthisical patients.

Débove discovered, by accident, that in cases in which all food introduced into the stomach in the ordinary way was rejected by vomiting, food introduced by the œsophageal tube was, strange to say, retained; and on this observation he founded his method of artificial "*suralimentation.*" He finds he is able to introduce by this means into the stomach an "excess" of food which is retained and digested; and he truly observes, that a person with phthisis requires considerably more food than a person in health on account of the considerably greater bodily waste taking place. He has also observed that the digestive power of the patient has no relation with appetite. "A patient who has no appetite, or who has a marked disgust for all food, will digest perfectly a large meal introduced by the tube, and even at the end of a certain time will recover appetite." *

As the results of *suralimentation*, or excess of food, he has observed disappearance of night sweats, diminution and disappearance of cough and expectoration, increase of strength, rapid gain in weight, and at the same time a considerable amelioration in the physical signs.

By the use of powdered raw meat, Débove, and

* "Leçons Cliniques et Thérapeutiques sur la Tuberculose Parasitaire," p. 82.

give our patients the power to resist their disease; as when the vine is attacked by the phylloxera, one of the best remedies is to manure well the land; by so doing, we do not destroy the parasite, but we give the plant the force necessary to struggle against it."

Since the adoption of powdered raw meat for *sur-alimentation*, the introduction of food into the stomach by means of the œsophageal tube is reserved for those cases in which, owing to irritability of the gastric mucous membrane, food taken in the ordinary way cannot be retained in the stomach.

While we should do all in our power to encourage our phthisical patients to take an abundance of nourishing food (and for this purpose we should make their diet as varied and attractive as possible), we must be careful not to admit into their dietary forms of food which, although attractive to the patient, tend to exhaust his digestive forces without rendering him an equivalent amount of support and nourishment. We should, therefore, exclude pastry, uncooked fruits, salads, pickles, and all forms of indigestible food. H. Weber objects to potatoes on account of the amount of potash they contain. "Experience shows that the exclusive or even preponderating use of potatoes favours scrofula."

It would be undesirable to fix too rigidly the daily dietary of the phthisical, but the following scheme may serve as a general guide—a sort of plan of route from which wide excursions may be made under the guidance of a discreet physician:—

On waking in the morning, a tumblerful of milk should be taken mixed with a little hot water, to which it is often useful to add a few grains of common salt and bicarbonate of soda, especially when a certain amount of accumulated mucus has to be got rid of by expectoration. There is no objection to taking a little tea, coffee, or cocoa at this hour, with

or tapioca soup, according to taste, may be taken. And, finally, some provision of light nourishment mixed with a little stimulant should be arranged in order to be taken during the night when woke by coughing or after perspiration, or when merely restless.

A glass of Vichy water, taken warm, half an hour before meals, as recommended by G. Sée, may be found useful in some cases and to promote the secretion of gastric juice.

In distinctly febrile cases a much more fluid dietary will have to be followed, and the food will require to be taken at shorter intervals.

dilatation; in cases of flatulent dyspepsia induced by too free use of tea, coffee, and other beverages; and in certain cases of excessive corpulence. In considering the dietetic treatment appropriate to the last condition, we have pointed out how and to what extent the limitation of fluids may be applied. It must, however, be borne in mind that in gouty cases, with a tendency to uratic deposits, a deprivation of water is calculated to do harm.

In some of the preceding chapters we have had occasion to dwell at some length on the application of a milk diet to the treatment of certain morbid states, and it will be unnecessary to repeat here what has been fully considered elsewhere. But the so-called "Milk" cure has been systematically applied to the relief of many other ailments, and the method adopted we shall now briefly describe.

Karell, of St. Petersburg, has been one of the chief advocates of an exclusively milk diet in certain diseases, and Weir Mitchell has to some extent adopted his views and extended their application.

In connection with this subject Weir Mitchell observes: "The study of the therapeutic influence and full results of exclusive diets is yet to be made; nor can I but believe that accurate dietetics will come to be a far more useful part of our means of managing certain cases than as yet seems possible."*

The following are the diseases in the treatment of which an exclusively milk diet has been found of value:—Dropsies of all kinds, cardiac, renal, and hepatic; obstinate intestinal neuralgias; incorrigible dyspepsias with grave disturbances of nutrition; hepatic disorders, such as hyperæmia, simple hypertrophy, and fatty liver; asthma, when the consequence of pulmonary catarrh and emphysema; hysterical

* "Fat and Blood," Fifth edition, 1888.

second week two bottles a day may be taken, at fixed intervals—viz. 8 a.m., 12 noon, 4 p.m., and 8 p.m. These hours may be changed, but the intervals must be maintained.

When there is great objection on the part of the patient to its use, with nausea or disgust, Weir Mitchell allows it to be flavoured with a little tea, coffee, caramel, or salt. He also advises, in certain cases, that the general diet should be displaced slowly until the exclusive milk diet can be tolerated. When it provokes acidity some alkali may be added, such as lime-water or Vichy water; or it may be scalded with a quarter boiling water and a little carbonate of soda, and salt added; or a little barley- or rice-water may be mixed with the milk to prevent firm clotting, as described in the section on "Food in Infancy."

Karell asserts that, although he commences with such small doses, the patients never complain of either hunger or thirst; and he adds that, if patients who are seriously ill attempt to take, instead of the four cups of skimmed milk, four large glasses of milk direct from the cow, they will certainly not be able to digest it, and the treatment will be discredited. In obstinate sickness and diarrhœa he has obtained the best results from these small doses, and he cites one such case in which he gave only four tablespoonfuls of skimmed milk three times a day. No doubt, in a case of this kind, the almost absolute rest of the digestive organs which such treatment affords, is an important agent in the cure.

Constipation he considers a natural consequence and a good sign—a sign that the milk is absorbed. It may be remedied by a simple enema of water, or by a small dose of castor oil or rhubarb; and if obstinate a little coffee should be mixed with the morning milk, or some stewed prunes or a baked apple may be eaten at 4 p.m.

uric acid disappears almost entirely from the urine, which assumes "a singular greenish tint," and when hot nitric acid is poured upon it, it no longer gives the usual mahogany tint at the plane of contact; and it would seem that, during a diet of milk, "the ordinary pigments of the urine disappear, or are singularly modified." The substances which give rise to the ordinary fæcal odours also disappear.

"The changes here pointed out are remarkable indications of the vast alterations in assimilation, and in the destruction of tissues which seems to take place under the influence of this peculiar diet." *

In many of the German and Swiss Spas, and especially in those with alkaline and salt springs, where chronic catarrh of the respiratory organs is treated, such as Ems, Ischl, Reichenhall, etc., the so-called "Whey cure" is applied. This consists in drinking warm whey either alone, or mixed with the mineral water, in definite quantities, at set times. Many physicians regard this practice as, in all respects, similar to the use of skimmed milk, and in no respect preferable except in persons who find the casein of milk indigestible. About 20 oz. daily are taken.

It relieves irritable laryngeal coughs, and exercises a favourable influence over chronic laryngeal and bronchial catarrhs. It has been found useful in certain forms of dyspepsia, and in chronic phthisis. It acts also as a diuretic, especially in combination with the saline mineral waters, and recent observations have shown that *lactose* possesses distinctly diuretic properties.

The "whey cure" is not an exclusive diet cure, but it is usual to strictly limit the quantity of animal food taken, and to augment the amount of fruit and vegetables; it adds, however, to the diet a certain

* "Fat and Blood," p. 103, 5th edition.

near mountain ranges, where they can get running water and salt-beds. They should be able to bathe frequently, and they must not have either hay or oats.

There are two kinds prepared, one light and slightly fermented, the other strong and highly fermented.

The patients are made to rise early and take a glass of koumiss every half-hour, except during the two hours preceding dinner and supper. Meat and fats form the chief part of the ordinary food; sweets, fruit, and salads are avoided, as well as ices, coffee, and spirits.

Lime-water is used to arrest the diarrhœa koumiss often causes. At first a few glasses only are taken daily so as to accustom the patient gradually to the cure.

Most invalids digest it well; it relieves constipation and acts as a diuretic. They gain in weight and show signs of increased blood-formation. Tent-life and much exercise in the open air are no doubt important adjuncts to the cure.

We have already mentioned, in a former chapter, Annaeff's and Postnikoff's establishments at Ssamara, as the best places for following this cure.

Good koumiss is a milky-looking, frothy liquid, with an agreeable slightly acid taste. It contains about 1 per cent. of alcohol and lactic acid. Its ready digestibility has been referred to the alcohol in it stimulating the digestive secretions, and the carbonic acid allaying gastric irritability.

The proportion of alcohol in koumiss is too small to produce any symptoms of intoxication; but a tendency to sleep and to mental and bodily languor has been noticed to follow its use. Excitement of the sexual organs has also been noted by several observers to follow the use of koumiss.

The treatment in the Steppes lasts two or three months, and is often renewed the following summer.

stage of phthisis, in the second stage it simply improves the general condition, in the third stage it is badly borne; that it is especially curative in cases of defective nutrition generally — cases of anæmia, chlorosis, malarial cachexia, scrofula, etc.

Artificial koumiss is prepared in England by the Aylesbury and other dairy companies.

The koumiss cure has been well and briefly defined as "essentially nothing more than a high nutrition of the sick."*

The *grape cure* is another dietetic cure of which a brief account must here be given.

The nutritive value of grapes is not great; they, however, contain much sugar as well as potash salts. They are an agreeable form of food, and afford one of the few means at our disposal between nutritive substances on the one hand and medicinal substances on the other. Much of the benefit referred to this cure may doubtless be attributable to the climatic advantages presented by those agreeable localities, such as Meran and Montreux, where it is usually followed.

Professor Lebert speaks of the grape cure as essentially a dietetic cure, notwithstanding its refreshing and aperient effects; and he is quite opposed to the consumption of very large quantities, as has been advised by some authorities, and considers that only moderate quantities should be prescribed. The effect of the cure is aided by a good supporting diet. Pulmonary patients should not take more than an average of 2 lb. daily, beginning with about a pound; and other patients should not exceed 4 lb. In cases of gastric catarrh 3 lb. a day may be eaten, the diet at the same time being carefully regulated. Constipation, with hepatic congestion and "abdominal

* Bauer, "Dietary of the Sick," p. 357.

Some irritation of the gums is apt to be excited during the cure; this may be relieved by rinsing the mouth with cold water, to which a little bicarbonate of soda is added. It has also been recommended that the patient should, while eating the grapes, take from time to time a small piece of fine white bread to remove the acid adhering to the teeth.

Towards the end of the cure, which lasts from four to six weeks, the quantity of grapes should be gradually diminished.

The mean composition of grapes, according to König, is water, 78·17 per cent.; sugar, 14·36; free acid, 0·79; nitrogenous substances, 0·59; non-nitrogenous extractives, 1·96; stones and woody fibre, 3·60; total ash, 0·53. The ash consists chiefly of potash salts, together with salts of lime and magnesia.

We have already indicated certain cases in which the grape cure may prove beneficial. It is also prescribed with success in those cases of "abdominal plethora" associated with a deposition of much superfluous fat; much of this fat may be removed if the laxative influence of the grapes is aided by a spare diet in which the fats and carbo-hydrates are strictly limited. It cannot be credited with any real curative influence in phthisis, but it appears to be useful in cases of chronic bronchial catarrh and emphysema; and it may no doubt relieve the bronchial catarrh which accompanies most cases of phthisis.

It has been found beneficial in cases of gastric and intestinal catarrh in anæmic persons, in vesical catarrh, in gouty concretions, and in cases of malarial cachexia.

wider-reaching digestive action than either of the others, as it not only digests nitrogenous foods and converts albuminates into peptones, but it has the power of converting starch into dextrin and sugar, and it further possesses the property of emulsifying fats; so that nearly all the pre-digested or partially pre-digested foods—*i.e.* all the *peptonised* foods—now in use are peptonised by the addition of the pancreatic ferments.

We propose to examine briefly the properties and uses of each of these three artificial digestive agents.

An objection, it seems to us, of a somewhat singular character has been made to the employment of pre-digested foods, viz. that they usurp the gastric and duodenal functions, and that their use is demoralising (!) to the healthy stomach. No one dreams of objecting to crutches on the ground that they are demoralising to those who are not lame, because no one imagines they will ever be ordered for persons with sound limbs. So with these artificial digestive agents, they are intended and devised for the *sick* and not for the *sound*, for the *abnormal* stomach, not the *normal* one, to supply what is defective, not to add to what is already abundant, and it is a perfectly gratuitous objection to assert that they are demoralising in certain healthy conditions, in which it was never intended they should be used! No valid objection, that we are aware of, has been made to their use in those disorders of the digestive functions for which they are especially appropriate.

And first with regard to the use of *Malt extracts* and Malted food in general. It must be borne in mind that these are simply pre-digested starches, together with other nutritive substances, and it must not be concluded that they can supplement or reinforce the pancreatic digestion of starch *in the small intestine*, for the amylolytic ferments are wholly inactive

milk, and it is directed to be made in the following manner :—

Mix well ½ an ounce of ground malt, with ½ an ounce of wheat flour, and 7¼ grains of potassium bicarbonate ; add 1 ounce of water, and 5 ounces of fresh cow's milk. Warm over a slow fire, and keep stirring until it gets thick. Remove from fire, stir for five minutes, replace it on the fire, and again remove it as soon as it gets thick. As the starch gets converted into dextrin and sugar by the diastase of the malt it will become a thin and sweet liquid. Then finally boil it well. Strain through muslin.

This food is highly nutritious; besides the constituents of the milk, it contains pre-digested starch (dextrin and maltose) and the albuminates (gluten and albumen) of the wheat flour and of the malted barley.

Foods composed (as some malted foods are) of malted flour and desiccated milk, when mixed with water, are defective as the sole food for children, as they do not contain the adequate proportions of fats, proteids, and salts; but these can be readily increased by the addition of a little cream, or rich milk, or some raw meat juice. In preparing the various malted foods it is usual to bake the wheat flour, so as to render the starch granules more soluble.

Mellin's, Nestlé's, Savory and Moore's, Allen and Hanbury's infant foods are examples of these malted preparations. The two latter are not completely predigested, so that something is left to exercise the child's digestive organs; and Savory and Moore use "whole wheat meal," and their food, therefore, contains more of the nutrient constituents of the grain.

Pepsin, the proteolytic ferment of the gastric juice, acts only when in combination with an acid, and preferably hydrochloric acid. In contact with a dilute solution of sodium carbonate, at the temperature of

ferment into the small intestine; for the proteolytic action of trypsin is arrested in an acid medium like the gastric juice, and the gastric pepsin aids in the destruction of the ferment. "Hence, it is obvious that pancreatic extracts or ferments given by the mouth can be of no value whatever, since the proteolytic ferment, at least, will undoubtedly be destroyed in the stomach before reaching its normal sphere of action." *

If, however, as seems possible, the pancreatic extracts could be administered in capsules composed of a substance insoluble in dilute acid, but soluble in alkaline fluids, and be so conveyed through the stomach harmless to the duodenum, the difficulty would be overcome. (*Keratin* appears to be a substance of this kind.)

Trypsin acts best in an alkaline medium, and pancreatic extracts are usually mixed with an alkali; but it is also active in a neutral medium.

Peptonised foods, strictly speaking, are artificially-digested albuminates, and might be made with pepsin and hydrochloric acid, as well as with pancreatic extract; but the latter is generally used, and when applied to foods containing carbo-hydrates, or fats, as well as albuminates, its amylolytic and emulsifying properties also come into operation, and we obtain a very completely pre-digested food.

Pancreatin and the pancreatic peptones decompose very readily, and for this reason it is important in using them to be careful that no poisonous ferments are thereby introduced into the organism.

Meat peptones are, no doubt, highly nutritious, but they are often of an unpleasant taste and odour: the smell of pure muscle peptone is stated by Zuntz to be very objectionable, and the more agreeably

* Prof. Chittenden on "Digestive Ferments." *Philadelphia Medical News*, Feb. 16, 1889.

The best of these are Benger's liquor pancreaticus, Benger's peptonising powders, and Fairchild's *zymine*, a very convenient and active pancreatic extract, introduced by Messrs. Burroughs and Wellcome, and supplied in air-tight glass tubes, each containing the exact quantity of pancreatic extract (5 grains), and sodium bicarbonate (15 grains) required to peptonise one pint of milk. These pancreatin powders are very hygroscopic, and it is important that they should be kept in air-tight glass tubes such as these.

Milk can be readily peptonised by these pancreatic extracts, the casein is converted into soluble peptones, and it thus becomes a most valuable food for delicate infants and others who cannot digest the coagulated casein of cow's milk. If, however, the milk be *completely* peptonised, it acquires a bitter taste which renders it unpleasant, and children will object to take it; but if, as we shall describe, the process of peptonisation be arrested at the proper time, and the milk be only partially peptonised (which, for other reasons, is an advantage), no disagreeable bitter taste is developed.

The method of peptonising milk by means of Fairchild's peptonising powders is very simple.

Into a clean quart bottle pour a pint of milk, add a quarter of a pint of water, and a tube of Fairchild's powder; shake them together. Put the bottle into water as hot as the hand can bear (about 150° F.), and let it stand for half an hour; then boil for two or three minutes. It is then ready for use. It should be kept in ice, or freshly made for each feeding. Boiling is for the purpose of permanently arresting the action of the ferment; cold will arrest it temporarily, and if kept covered with ice it is not necessary to boil it.

If the milk be allowed to stand longer than half an hour, peptonisation will proceed too far, and undesirable bitter products will be generated.

Peptonised beef-tea can be made in the following manner :—Take half a pound of finely-minced lean beef, add to it a pint of cold water, and cook over a gentle fire till it boils. Decant the beef-tea into a jar or bottle, rub the meat into a paste, add it to the beef-tea, and mix in another pint of water to reduce the temperature to about 140° F. Add a table-spoonful of liquor pancreaticus, or sixty grains of Fairchild's pancreatic extract, and twenty grains of sodium bicarbonate. Stand in a warm place for three hours, shaking occasionally ; then boil quickly for two or three minutes and strain.

This is a weak beef-tea, but it can be made of any strength required.

Following this method various foods can be pre-digested or peptonised according to the wants and tastes of the invalids.

Bauer praises very highly Leube's meat solution, as it contains, besides peptones, some unaltered albumen. It is made by exposing meat and dilute hydrochloric acid to a high temperature in air-tight vessels.*

In *rectal alimentation*, the unpleasant flavour of meat peptones is no bar to their employment, and they have been found very useful in this method of artificial feeding.

But it is necessary to inquire here to what extent the nutrition of the body can be maintained by the administration of food solely in the form of rectal enemata?

It has been ascertained experimentally that soluble

* 1,000 grammes of lean meat minced fine are placed in a porcelain vessel with 1,000 centigrammes of water, and 20 centigrammes of pure hydrochloric acid. This is placed in a closed Papin's digester and boiled for 10 to 15 hours. The mass is then taken out and rubbed in a mortar to a paste. It is again boiled in the closed digester for another 16 to 20 hours ; after this it is neutralised with pure sodium carbonate, and evaporated to a syrupy consistence. —Bauer, "Dietary of the Sick," p. 88.

cause no irritation of the mucous membrane of the rectum, and can be retained from 12 to 36 hours. Evidence was also obtained by Leube that a considerable portion of the albumen and fat of such enemata was absorbed.

Owing to the difficulty of keeping pancreatic extracts sweet, Wood * has advised the preparation of a glycerine extract made by rubbing down bullocks' pancreas with glycerine, and adding some of this to finely-divided meat for each injection ; but the known aperient action of glycerine when injected into the rectum would surely lead to the speedy rejection of such enemata.

Peptonised milk-gruel or peptonised beef-tea, mixed with some soluble carbo-hydrate, such as maltine, or a mixture of one of the malted foods and peptonised milk, are useful preparations for rectal alimentation. Small quantities of wine or brandy may be added to such enemata when stimulation is indicated.

It is advisable to wash out the rectum with pure water an hour before administering a nutrient enema. Only a small quantity should be injected at a time, from 1 oz. to 3 oz. ; a larger quantity is liable to be rejected. The tube should be well oiled to avoid setting up soreness or irritation at the anus, and it is well to use a long one so as to inject the fluid as high up as possible in order that it may come in contact with a more extensive absorbing surface. The addition of opium to the injection may insure retention, but it may also retard absorption.

Peptonised *suppositories* are also prepared containing peptonised concentrated milk, or meat, together with digested oil. These are said to have sustained life for weeks without exciting any rectal irritation.

* "Therapeutics."

APPENDIX I.

HOSPITAL DIETARIES.

No precise scientific data are available for estimating the *quantity* of food appropriate and sufficient for the various classes of invalids; and when it is considered how different are the conditions, as affecting the nutritive needs and digestive capacities presented by different individuals suffering not only from different, but even from the same maladies, it would seem almost impossible that such precise and accurate data should ever be obtainable. Under these circumstances our only reliable guide is that furnished by the prolonged and observant experience of those who have had the direction and care of institutions adapted for the reception of the sick. It will, therefore, be of some practical value to collect together and compare a certain number of those dietaries which the experience of such institutions has shown to be suitable and sufficient.

In most of these dietaries wide scope is usually given for the introduction of "extras," which is an acknowledgment of the necessity for permitting great latitude in estimating the quantity of food requisite for individual cases.

In the estimate made by Bauer, from the tables accessible to him, of the relative quantities of albumen, fat, and carbohydrates (in grammes) contained in the dietaries of some of the principal English hospitals, the variations, especially in the quantity of fats, appear to be considerable.

It is probable, however, that these calculations were made from tables that, in some instances, are no longer in use.

	Albumen.	Fat.	Carbo-hydrates.	Total.
Middlesex Hospital . .	85	28	297	410
St. Bartholomew's Hospital	83	50	291	424
Consumption "	83	32	254	369
St. George's "	100	65	308	473
Westminster "	125	43	388	556
German "	97	68	309	474
Margate Sea Bathing Infirmary	123	55	438	616

In those Hospitals in which the diets are classified mainly into "Full," "Middle," and "Milk" diets, it may be

It is certainly somewhat remarkable to find such wide variations as are apparent in the above tables of "Full Diets" in some of our principal hospitals, especially as those are the diets usually allotted to convalescents or to surgical cases, and they are diets with which it is not usual to order "extras."

The quantity of *cooked meat* varies from 4 oz. at St. Thomas's to 8 oz. at St. Bartholomew's! In four *no* butter is provided, and in the other the quantity allowed varies from $\frac{1}{2}$ oz. to 1 oz. In such essential articles of diet as these more uniformity might surely be expected.

MIDDLE DIETS.

Guy's.	*King's College.*	*London.*	*Bartholomew's.*
Bread, 12 oz. Butter, 1 oz. Meat, 4 oz. Potatoes, $\frac{1}{2}$ lb. *On alternate days:* Mutton broth, $\frac{1}{2}$ pint, or milky rice pudding, $\frac{1}{2}$ lb. Porter, $\frac{1}{2}$ pint; or milk. Tea and sugar.	Bread, 12 oz. Meat, men, 4 oz.; women, 3 oz. Potatoes, $\frac{1}{2}$ lb. Gruel, 1 pint. Porter, $\frac{1}{2}$ pint. Milk, $\frac{1}{2}$ pint.	Bread, 12 oz. Meat, 4 oz. Potatoes, $\frac{1}{2}$ lb. Porter, $\frac{1}{2}$ pint; or milk, $\frac{1}{2}$ pint.	Bread, 12 oz. Butter, $\frac{3}{4}$ oz. Meat, 4 oz. Potatoes, $\frac{1}{2}$ lb. Beer, 1 pint. Tea, 2 pints.

University College.	*Westminster.*	*Great Northern.*	*St. Thomas's.*
Bread, 12 oz. Meat, 4 oz.; or fish, 8 oz. Potatoes, $\frac{1}{2}$ lb. Soup (with barley), $1\frac{1}{2}$ oz.; or beef tea, 1 pint; or rice pudding, with milk. Milk, 1 pint. Beer (if ordered), $\frac{1}{2}$ pint.	Bread, 10 oz. Butter, $\frac{3}{4}$ oz. Meat, 3 oz. Potatoes, $\frac{1}{2}$ lb. Milk gruel, 1 pint Tea, $\frac{1}{3}$ oz. Sugar, 1 oz. Milk, $\frac{1}{2}$ pint.	Bread, 12 oz. Butter, $\frac{1}{2}$ oz. Meat, 4 oz. Potatoes, 8 oz. Broth, $1\frac{1}{2}$ pint. Milk, $\frac{1}{2}$ pint. Tea or coffee, $1\frac{1}{2}$ pint.	Bread, 12 oz. Butter, $\frac{3}{4}$ oz. Meat, men, 4 oz.; women, 3 oz. Potatoes, $\frac{1}{2}$ lb.; or fresh vegetables. Rice or bread pudding, 8 oz.

St. Mary's.	*St. George's.*	*Middlesex.*
Bread, 12 oz. Butter, 1 oz. Meat, 4 oz. Potatoes, ½ lb.; or other vegetables. Milk, ½ pint. Milk or beef tea, 1 pint. Tea, coffee, or cocoa, 2 pints, with sugar.	Bread, 12 oz. Butter, 1 oz. Meat, 3 oz. Potatoes, ½ lb. Milk, ½ pint. Porter, ½ pint. Gruel, 1 pint. Tea, 2 oz. weekly. Sugar, ½ lb. weekly.	Bread, 10 oz. Meat (uncooked, and with bone!), 6 oz. Potatoes, ½ lb. Milk, ½ pint. Beef tea, strong, ½ pint.

Brompton.	*Royal Chest.*
Bread, 13 oz. Butter, 1 oz. Meat, 4 oz. Egg, or bacon. Potatoes, 5½ oz.; and other vegetables. Milk, gruel, or soup, ½ pint. Pudding, 8 oz. Tea, coffee, or cocoa, 1 pint. Treacle.	Bread, 12 oz. Meat, 4 to 6 oz. Potatoes, ½ lb. Milk, ¾ pint. Milk or cocoa, ½ pint. Light pudding (with milk and eggs), 6 oz.

It is certainly regrettable that more uniformity in the estimation of the quantities of food necessary for invalids is not observable in these tables.

In some hospitals the diets are not specially named, but simply numbered; as in the following:—

Charing Cross Hospital.

No. 1 Diet.—Milk, 4 pints; beef-tea, 1 pint.
 „ 2 „ —Bread, 9 oz.; butter, 1 oz.; broth or beef-tea, 1 pint; milk, 2 pints; milk pudding.
 „ 3 „ —Bread, 12 oz.; butter, 1 oz.; meat, 4 oz.; potatoes, ½ lb.; milk, 1 pint; milk pudding.
 „ 4 „ —Bread, 12 oz.; butter, 1 oz.; meat, 6 oz.: potatoes, ½ lb.; milk, 1 pint; milk pudding.

Royal Free Hospital.

No. 1 Diet.—Bread, 8 oz.; beef-tea, ½ pint; gruel, 1 pint; coffee, ¾ pint; milk, ¼ pint.

Children's Hospital.

Milk Diet.—Bread, 6 oz. (with butter); milk, 2 pints; rice, or other milk pudding.

Broth Diet.—Bread, 7½ oz. (with butter or dripping); milk, 1¼ pint; mutton broth, made with vegetables, ½ pint.

Beef-tea Diet.—Bread, 5 oz. (with butter); milk, 1½ pint; beef-tea, 13 oz.

Fish Diet.—Bread, 8 oz. (with butter, dripping, or treacle); milk, 1 pint (or milk, ½ pint, and cocoa, ½ pint); sole, boiled, 2½ oz.; potatoes, mashed, 3 oz.

Meat Diet.—Bread, 6½ oz. (with butter, dripping, or treacle); milk, 1 pint (or milk, ½ pint, and cocoa, ½ pint); meat, 2½ oz.; potatoes, mashed, 4 oz.

London Fever Hospital.

Low Diet.—Bread, 6 oz.; milk, ½ pint; gruel, 1 pint; sugar, ¼ oz.

Beef-tea Diet.—Bread, 4 oz.; milk, 1 pint; beef-tea, 1 pint.

Middle Diet.—*Males*, bread, 10 oz.; milk, 1 pint; broth, 1 pint; rice, or bread (for pudding), 2 oz.; egg (for pudding), 1; sugar (for pudding), ½ oz. *Females*, 2 oz. less bread.

Fish Diet.—*Males*, bread, 12 oz.; fish (sole, haddock, cod, or brill), uncooked, 8 oz.; potatoes, 8 oz.; cocoa, 1 oz.; sugar, ½ oz.; milk, ⅛ pint. *Females*, 2 oz. less bread.

Full Diet.—*Males*, bread, 16 oz.; meat, 12 oz. (*uncooked*, and without bone); potatoes, 12 oz.; cocoa, 1 oz.; sugar, ½ oz.; milk, ¼ pint; beer, 1 pint. *Females*, 4 oz. less bread, 2 oz. less meat; beer, ½ pint.

The following extras may be prescribed:—

Beef-tea, strong beef-tea, and eggs, as ordered.

Arrowroot, ½ oz.; custard pudding—1 egg, ½ pint milk; ½ oz. sugar; tea, ¼ oz. per day; sugar, 1 oz. per day; butter, 1 oz. per day.

Extras which are largely ordered by the physicians and surgeons in London hospitals are thus very fully enumerated in the diet tables of the *Middlesex Hospital.*

Chops (mutton, or pork), ½ lb. when trimmed; *steak*, rump, ½ lb.; *chicken*, a quarter; *sausages*, ½ lb.; *rabbit*, a quarter; *tripe*, ½ lb.; *bacon*, 3 oz.; *strong beef-tea* (12 oz. beef to pint); *jelly beef-tea* (24 oz. to pint); *broth* (neck of mutton, with bone, ¼ lb. to pint), without meat; *chicken broth* (½ chicken to pint); *oysters*, *greens*, *suet pudding*

(beef suet, 1 oz.; flour, 2 oz.); *custard pudding*, *arrowroot*, *sago*, *oatmeal gruel* (3 oz. to pint); *eggs*, *jellies*, *porter*, *ale*, *stout*, *wine*, *spirits*, *oranges*, *lemons*, *meat essences*.

The *hours* and *apportionment* of food are exemplified in the following extract from the diet tables of St. Mary's Hospital:—

Ordinary Diet.

Breakfast, 6 a.m.—Tea, coffee, or cocoa, with sugar, 1 pint; milk, ¼ pint; bread and butter.
Dinner, 12 noon.—Meat, 4 oz.; potatoes, or other vegetables, ½ lb.; bread.
Tea, 4 p.m.—Tea, coffee, or cocoa, with sugar, 1 pint; milk, ¼ pint; bread and butter.
Supper 7 p.m.—Beef-tea, milk, or cocoa, 1 pint; bread and butter.

APPENDIX II.

INVALIDS' DIETARY.—SELECT RECIPES.

1. Almond Cakes for Diabetics (Seegen's), p. 431.

2. ALUM WHEY (*an astringent drink*).—To a pint of boiling milk add ¼ oz. of powdered alum previously mixed with three or four tablespoonfuls of hot water. Strain.

3. ARROWROOT.—Mix two teaspoonfuls of arrowroot with three tablespoonfuls of cold water; add half a pint of boiling water, constantly stirring. Milk may be used instead of water. Flavour with sugar, nutmeg, lemon-peel, or other spice. Add port wine or brandy, if required. (Some advise boiling for three minutes in an enamelled saucepan.)

4. Artificial Human Milk (Frankland's), p. 302.

5. Barley Jelly (Eustace Smith), p. 306.

6. BARLEY WATER.—On a tablespoonful of pearl barley (washed in cold water), the rind of a lemon peeled thin, and two or three lumps of sugar, pour a quart of boiling water. Let it stand for seven or eight hours, and strain. More or less of the juice of the lemon may be added, according to taste.

7. BARLEY WATER (Bartholow).—Wash 2 oz. of pearl barley with cold water. Then boil it for five minutes in some fresh water, and throw both waters away. Then pour on two quarts of boiling water, and boil it down to a quart. Flavour with thinly-cut lemon-rind, and sugar to the taste; but do not strain unless at the patient's request.

8. Beef Essence, p. 382.

9. BEEF JUICE (Bartholow).—Broil quickly some pieces of round or sirloin, of a size to fit in the cavity of a lemon-squeezer. Both sides of the beef should be quickly scorched to prevent the escape of the juices, but the interior should not be fully cooked. As soon as ready, the pieces should be pressed in the lemon-squeezer, previously heated by being dipped in hot water. The juice, as it flows away, should be received into a hot wine-glass, and after being seasoned to the taste with salt and a little cayenne pepper, taken while hot.

granules of starch, and promote its conversion into dextrin and glucose.

Rub this semi-fluid gruel through a fine hair-sieve; when cold, it forms a smooth jelly.

It will not keep long, and must be prepared twice daily.

For children who can digest no milk, this jelly may be simply mixed with enough warm water (one tablespoonful to 8 oz. of water) so as to have the consistence of thin cream, and a little refined sugar added.

To make it, however, a suitable food for more than mere temporary purposes, it would need the addition of some albuminate and some fat. Its percentage composition, mixed in the proportions stated, is proteids 0·74, fat 0·13, carbo-hydrate 4·15.

If the addition of milk can be tolerated, then a mixture of 3 oz. of bread-jelly to 4 oz. of milk (or peptonised milk) and 4 oz. of water will make a fairly good food; or the necessary amount of proteid and fat may be obtained by the addition of raw-meat juice and cream (the raw-meat juice being prepared by expression from a mixture of four parts meat and one part water).

Dr. Cheadle* recommends as a highly nutritious food for children a mixture of four parts of the above bread-jelly mixture (with water only), three parts of raw-meat juice, half a pint of cream, and one-fifth part of sugar. The raw-meat juice must be quite fresh, and made twice a day.

20. Broth, Cold (Parkes), p. 176.

21. Caudle.—Beat up an egg to a froth; add a glass of sherry and half a pint of gruel. Flavour with lemon-peel, nutmeg, and sugar.

22. Celery stewed, for Rheumatism, p. 96.

23. Chicken Broth (Bartholow).—Skin and chop up small a small chicken, or half a large fowl, and boil it, bones and all, with a blade of mace, a sprig of parsley, and a crust of bread, in a quart of water, for an hour, skimming it from time to time. Strain through a coarse colander.

24. Chicken, Veal, or Mutton Broth may be made like beef-tea (No. 11), substituting chicken, veal, or mutton for beef, boiling in a saucepan for two hours, and straining. For chicken broth the bones should be crushed and added. For veal broth the fleshy part of the knuckle should be used. Either may be thickened and their nutritive value

* "Artificial Feeding of Infants."

a jug, and pour over them a quart of boiling water. When cold, decant the liquid, and add a tablespoonful of lemon-juice.

37. Liebig's Infant's Food, pp. 299, 540.

38. Lime-water, p. 303.

39. LINSEED TEA.—To a pint of water add two tablespoonfuls of linseed, half a lemon, ¼ oz. of bruised liquorice root (or a piece of liquorice the size of a filbert), and sugar-candy to taste. Boil for an hour and a half, and strain.

40. Macaroni à l'Italienne (Sir Henry Thompson), p. 194.

41. MALT (GROUND) AND RICE PUDDING.—Stir an ounce of ground malt into a pint of boiling milk; strain through a sieve, and add the milk to 2 oz. of well-soaked rice. Mix well, and stand for ten minutes in a warm place; then bake for an hour.

42. Meat Biscuits (Parkes), p. 208.

43. Meat Solution (Leube's), p. 547.

44. MEAT TEA (Bartholow).—Put one pound each of beef, mutton, and veal, cut into small pieces, into three pints of cold water. It should simmer for three or four hours, but not boil. When finished, the tea should be carefully strained, and seasoned with salt, and cayenne pepper if preferred.

45. MILK AND SUET (Pavy).—Boil an ounce of finely-chopped suet with a quarter of a pint of water for ten minutes, and press through linen. Then add a dram of bruised cinnamon, an ounce of sugar, and three-quarters of a pint of milk. Boil again for ten minutes, and strain. A wine-glassful or two at a time. Nutritive and fattening.

46. MUTTON BROTH (Bartholow).—Boil one pound of lean loin of mutton, exclusive of bone, with three pints of water, till tender, throwing in a little salt and onion according to taste. Pour out the broth into a basin, and when it is cold skim off the fat. It can be warmed up as wanted.

47. OATMEAL GRUEL.—Mix thoroughly one tablespoonful of groats with two of cold water; add to this a pint of boiling water, stirring constantly. Boil and stir for ten minutes. Sweeten with sugar.

43. OATMEAL PORRIDGE.—To a pint of boiling water add half a teaspoonful of salt, and sprinkle slowly in three to four ounces of oatmeal till of sufficient thickness, keeping

59. **Raw Meat** (Ringer).—Cut into small squares 2 oz. of rump-steak free from fat, without entirely separating the meat; pound in a mortar for five or ten minutes; add three or four tablespoonfuls of water, and pound again for a short time; then remove all sinew or fibre of the meat, leaving only the creamy substance; add salt to taste.

Before using, place the cup or jar containing the pounded meat in hot water until just warm.

May be made into sandwiches with thin bread-and-butter. Useful in chronic diarrhœa.

60. **Raw Meat with Milk and Sugar** (Ringer).—Scrape with a knife half a pound of rump-steak until all the pulp is removed from it; sweeten with sugar, breaking the lumps of sugar with the meat in a basin with a small wooden spoon. Add slowly as much milk as will make it the thickness of arrowroot; flavour with brandy. Strain through a gravy strainer if there is any fibre of the meat in it, as the mixture should be perfectly smooth.

61. **Raw Meat with Fruit Jelly** (Adrian).—Mix 2 oz. of pulp of fillet of beef (made by scraping with a knife) and 15 grs. of common salt with 1 lb. of fruit jelly of any k nd.

62. **Raw Meat in Emulsion** (Yvon).—Take 2 oz. of pulp of raw meat, ½ oz. of blanched sweet almonds, about half one bitter almond, and ½ oz. of white sugar. Pound them together in a marble mortar, and add enough water to make an emulsion.

63. **Raw Meat Juice** (Cheadle).—Add to finely-minced rump-steak cold water, in the proportion of one part of water to four of meat. Stir well together, and allow to stand for half an hour. Forcibly express the juice through muslin by twisting it.

This contains, per cent.:—Albuminate 5·1, nitrogenous extractive 3·1, salts 0·7.

Dr. Cheadle calls this "the most easily digested and restorative of all animal foods; the most valuable of all nitrogenous preparations for children."

It mixes well with milk, and it is highly antiscorbutic. It does not keep well, and must be made fresh.

64. **Raw Meat and Tapioca Soup** (Dujardin-Beaumetz).—Take 1 oz. of raw-meat pulp, made by scraping meat (preferably mutton) into a fine pulp with a knife, mix it with half a pint of tapioca soup (No. 76).

65. Raw Soup (Weir Mitchell's), p. 503.

raw meat; its flavour may be improved by the addition of salt, and beef-tea not hot enough to coagulate the albumen.

75. TAPIOCA JELLY (Bartholow).—Soak a cup of best tapioca with a pint of cold water; when soft put into a saucepan with some sugar, the rind and juice of one lemon, a little salt, one pint more water; stir until it boils; turn into a mould; set to cool; add one glass of wine if desired.

76. TAPIOCA SOUP.—Boil a pint of meat broth or stock, and while kept constantly stirred sprinkle in ¾ oz. of previously-washed tapioca. Cover the saucepan, and let it simmer till the tapioca is quite soft. Skim and serve.

77. TREACLE POSSET. (*A diaphoretic drink for a cold.*)—To two or three tablespoonfuls of treacle add a pint of boiling milk. Boil up well, and strain.

78. VERMICELLI MILK SOUP.—Into a quart of boiling milk put a level saltspoonful of salt (or celery salt); add slowly (stirring constantly) 2 oz. of vermicelli; keep stirring for fifteen or twenty minutes, until quite soft. The yolks of two eggs should be added when the soup is ready to be removed from the fire. This soup may also be flavoured with cinnamon and sugar.

79. Whey (Lemon), p. 365.

80. Whey (Louis Starr's), p. 304.

81. WHEY MADE WITH CREAM OF TARTAR.—Mix a large teaspoonful of cream of tartar with two tablespoonfuls of hot water, and add this to a pint of boiling milk. Add a little sugar and lemon-peel. Let it stand till cold, and then strain.

82. WHEY (SWEET).—To a pint of milk add about a square inch of rennet, and slowly warm to about 100° Fahr. Stand for thirty minutes in a warm place, and then strain through muslin.

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NOTE.—*The French "gramme," used in the Text, is equal to* 15·432 *grains (roughly* 15 *grains), and* 28·3495 *grammes are equal to* 1 *oz. avoir. The "litre," as a fluid measure, is equal to* 35 *oz., or* 1¾ *imperial pint.*

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